















# INTERNATIONAL FOOD INFORMATION SERVICE

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FAB 20

November 1972

USE OF GLUCOSE IN FOOD PRODUCTS

SELECTED FROM VOLUMES 1, 2 & 3

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See also back page



## VOLUME 1

0 35  
mato catsup, identity standard; deletion of  
restrictions on use of dextrose, corn syrup, and  
cose syrup as sweetening ingredients.

on.  
ederal Register 33 (168, Aug. 28) 12139 (1968) [En]  
The standard of identity under the US Federal  
od, Drug and Cosmetic Act for catsup is  
vised to delete the requirement that dextrose (i)  
ay be used only in a mixture with sugar and to  
move the provision limiting the proportion of  
rn syrup and glucose syrup that may be used when  
e solids of the syrups contain a min. of 58% of  
ducing sugars calculated as anhydrous (i). CAS

G 34  
ethod for producing an edible ready to eat food  
stance.] Verfahren zur Herstellung eines ohne  
ochprozess verzehrfertigen Nahrungsmittels.  
hmidt, M. (Hoffmann's Stärkefabriken A.G.)  
est German Patent 1 275 854 (1968) [De]  
A mixture of grain flour or starch and a  
uid is heated to  $>100^{\circ}\text{C}$  at atm. pressure and  
ied. Before heating, 10-50% sugar or glucose are  
ded to the mixture. W&Co

1 312  
sing glucose for improving must products.] Die  
rwendung von Glukose zur Mostverbesserung.  
ushofer, H.; Dreher, E.; Bayer, E.  
tteilungen: Rebe, Wein, Obstbau und  
üchterwertung 18 (4) 268-73 (1968) [2 ref. De,  
fr, es] [Höhere Bundeslehr- und  
rsuchsanstalt für Wein- und Obstbau,  
sterneuburg, Austria]  
2 brands of dextrose (i), were compared with  
rose (ii) as additives to musts for the  
nufacture of special wines. No differences in  
mentation curves, ethanol yield (0.56 vol. %/kg  
ar), sp-gr., TS, acids or ash were obtained  
en (i) or (ii) were used. No technological  
sons prevent the use of (i) but price and legal  
uirements will be the deciding factors (in  
stria the use of (i) in musts is presently not  
w:d). AF

101  
pperminths.]  
operative Verkoop-en Productievereniging van  
dappelmehl en Derivaten.  
therlands Patent Application 6 703 355 (1968)  
] or producing confectionery which is cut into  
pe, particularly peppermints, usually an  
eous solution of gelatin is mixed with powdered  
ose, and peppermint oil and/or other  
ouring substances are added while kneading the  
ture, which is subsequently rolled into a thin  
r from which pieces are cut into shapes.  
ead of sucrose a mixture of sucrose and  $\leq 70\%$   
rose can be used as the main ingredient. The  
rose may be used in solid form. W&Co

3 M 180

Laevulose-containing corn syrup.

Piekarz, E. R.

Bakers' Digest 42 (5) 67-69 (1968) [19 ref. En]

[Fleischmann Division, Standard Sales Co., New  
York, N.Y., USA]

The purpose of bread sweeteners is discussed. A  
new corn syrup containing dextrose and  
laevulose is stable, uniform, and adaptable to  
most bakery operations. High solids content and  
low storage temp. properties and a uniform and  
stable pricing basis make it an important new  
product for the baking industry. EAW

4 H 384

Malt and cereal adjuncts.

Macey, A.

Process Biochemistry 4 (1) 17-19 (1969) [1 ref.

En] [ABM (Malting) Ltd.]

The replacement of barley malt as the traditional  
brewing raw material for beer has been advocated,  
and the author compares the cost reduction when  
using various adjuncts (wheat flour, maize  
flakes or grits, barley flakes) at 10, 20 and 30%  
levels. These and other adjuncts (glucose syrups,  
green malt extract and enzyme syrup) are examined  
for their economic feasibility as well as cost. A  
new malting technique using dehusked barley is  
discussed as having technical advantages and  
probable savings in costs. AL

7 T 210

[Sausage additive.]

Neraal, L. F.

Norwegian Patent 115 511 (1968) [No]

An additive for controlling the pH changes in  
sausages consists of a combination of gluconic  
acid  $\delta$ -lactone, non-pathogenic, nitrate-reducing,  
lactic acid-producing micrococci, and,  
optionally  $\geq 1$  mesophilic lactobacilli, e.g. L.  
plantarum or L. casei, together with substances  
such as polyphosphates, ascorbic acid and  
dextrose. The additive enables sausage products of  
improved quality to be obtained by controlling  
changes in colour, ripening, flavour and  
consistency. W&Co

8 G 341

[Sweetening composition.]

Sanei Kagaku Kogyo Co. Ltd.

Japanese Patent 6239/69 (1969) [Ja]

Mixtures containing artificial sweetening agents,  
liquorice and malt are either dried or absorbed on  
anhydrous glucose to yield sweetening  
compositions. IFT

8 L 322

Measurement of the relative sweetness of selected  
sweeteners and sweetener mixtures.

Stone, H.; Oliver, S. M.

Journal of Food Science 34 (2) 215-22 (1969) [18

ref. En] [Division of Life Sci., Stanford Res.

Inst., Menlo Park, California 94025, USA]

Relative sweetness of the simple sugars, sucrose,  
dextrose and fructose, and the synthetic  
sweeteners, calcium cyclamate and sodium  
saccharin, was measured by magnitude estimation.  
Changing the reference or reference concn.  
resulted in shifts in the relative sweetness  
values for a sugar; however, these were



consistent at all concn. tested. Mixtures of dextrose-fructose, dextrose-sucrose and sucrose-fructose were studied at several concn. combinations. IFT

8 N 335

Non-dairy sour cream improves flavour, texture of baked, frozen foods.

Anon.

Food Processing 30 (3) 35 (1969) [En] [Putman Publishing Building, 111 E. Delaware Place, Chicago, Illinois 60611, USA]

Hy-Derv, a non-dairy cultured product, has the physical characteristics of sour cream but not its variability. The liquid base material is compounded from UV treated vegetable fats, corn syrups and proteins and is pasteurized before the culture starter is added. 5 gal containers are UV treated, filled and held for 6-9 h at 65-75°F. Hy-Derv improves the quality of baked potato filling, cheese cakes, frozen pound cakes, butter cakes, muffins, doughnuts and chocolate products. SW

9 T 265

Dextrose improves body colour of pickle.

Anon.

Food Processing 30 (5) 38 (1969) [En]

Dextrose/H<sub>2</sub>O solutions have a high osmotic pressure and penetrate the pickle stock quickly. Damage to the pickle cells is reduced and firmer crisper pickles are produced. Yield may be increased up to 8% over sucrose sweetened pickles and discoloration is reduced giving longer shelf life. SW

11 G 464

Survival food composition and process for preparing the same.

India, Scientific Adviser to the Minister of Defence, New Delhi

Indian Patent 102 120 (1969) [En]

The composition contains in admixture glucose, sucrose, skim-milk, hydrogenated vegetable oil and gum. W&Co

11 L 562

[Effect of glucose syrups on the consistency of hard toffee.] Der Einfluss von Glukosesirupen auf die Beschaffenheit von Hartkaramellmassen.

Völker, H. J.

Zucker- und Süßwarenwirtschaft 22 (3) 114-16 (1969) [De]

Hard toffee masses are structureless, vitreous melts, the viscosity and solidity of which can be influenced by the addition of various amounts of starch syrup. Increasing doses of starch syrup raise the viscosity of melts in the range ~148°C markedly, though without any practical disadvantages in manufacturing technique. Lower degrees of hydrolysis of starch syrups also increase viscosity. The shear strength of poured melts is raised by increasing syrup additions. Sensitivity of the surface of stamped sweets to breakage and abrasion decreases with the increase of degree of hydrolysis. Enzyme syrups lower the stability against abrasion, but acceptable values are attained on applying higher doses. IN



## VOLUME 2

D 50

The food law situation of dextrose and glucose syrup.] Die lebensmittelrechtliche Stellung von Dextrose und Glucosesirup. [A lecture.] Schroeter, K. A.

Märkte 21 (8) 214-20 (1969) [49 ref. De, en, 1 [2 Hamburg 1, Spaldingstr. 218, W. Germany] Food laws concerning dextrose and glucose syrup in Germany, and drafts of supranational legal provisions are surveyed. Difficulties of classification of food constituents and additives are discussed. In Germany, dextrose can be used in place of sucrose in most products including ices and fruit juices, but excluding jams and marmalades and cocoa and chocolate products. Proposed EEC rulings provide for its free use, including in jams and marmalades and up to 20% by wt. of final product in cocoa and chocolate, where labelling is mandatory at levels above 5%. Glucose syrup is allowed by German law in fruit juices, deep frozen fruit and vegetables and processed vegetables, but restricted in alcohol-free fruit drinks and processed fruit. Proposed EEC rulings provide for up to 15% glucose syrup (final product wt.) in jams and marmalades and free use in fruit juices. RM

K 10

The effect of various substances in the blooming of chocolate.

Cerbulis, J.  
Journal of Food Technology 4 (2) 133-40 (1969) [22 ref. En] [Eastern Regional Res. Lab., USDA, Philadelphia, Pennsylvania 19118, USA]  
The effects of many edible substances and pure chemicals on chocolate have been studied in relation to the prevention of chocolate blooming. Fatty acids, cholesterol, other sterols and choline promoted the blooming of chocolate. Tripalmitin, added in good dispersion, made chocolate very resistant to fat bloom and the chocolate had a high gloss. Hydrogenated fats made chocolate very difficult to temper and it had a waxy taste. Only Delft 37 and some Edelfette improved the resistance of chocolate, but they made it waxy. Butylated hydroxyanisole (BHA) had undesirable effects. Anhydrous glucose added at the rate of 15-20% of the wt. of chocolate increased the resistance. Other sugars were either inert or diminished the resistance. Glycerol had a strikingly unfavourable effect on both quality and resistance. Amino acids did not exhibit any special influence on chocolate. Chemical additives and biological treatment also influenced the blooming of milk chocolate. Unusually long bloom crystals were produced on the surface of milk chocolate on special occasions. AS

L 54

Method of producing glucose beverages in powder form.]

Chor, V.; Simlova Z.

Czechoslovakian Patent 134 016 (1969) [Cs] [VU Skrobaren, Brno, Czechoslovakia]

A suspension of starch, sucrose, common salt, burnt sugar (caramel) and water or milk is prepared in a mixer and subjected to ultrasonic waves of 10-12 kc/sec, at a pressure of 10 kg/cm<sup>2</sup> and a temp. of 95-160°C. After having been dried at temp. up to 130°C, 39-40 parts sucrose are added, and the mixture is homogenized and cooled to 20°C; alternatively, the dried mixture is homogenized and 25 parts sucrose and 20 parts sorbitol are added. STI

2 G 85

Fat destabilization in frozen desserts containing low dextrose equivalent corn sweeteners.

Mahdi, S. R.; Bradley, R. L., Jr.  
Journal of Dairy Science 52 (11) 1738-41 (1969) [17 ref. En] [Dept. of Food Sci., Univ., Madison, Wisconsin 53706, USA]

Data collected with the aid of hanging drop slides and polyacrylamide gel electrophoresis indicated that  $\alpha_s$ - and  $\beta$ -casein complexed with low dextrose equivalent maize sweeteners and fluidity starch [acid-thinned maize starch] in frozen dessert mixes during pasteurization. Subsequent manufacture into frozen desserts caused a stripping of the complex from the surface of the fat globules which permitted aggregation. Frozen desserts containing 10-dextrose equivalent maize sweetener made from milo [100% amylopectin] did not show this defect. This suggested that the amylose fraction of maize sweeteners is involved in the complex with  $\alpha_s$ - and  $\beta$ -casein. [See also J. Dairy Sci. (1968) 51 (6) 931.] AS

3 K 31

Cadbury Schweppes' new cocoa processing factory at Chirk.

Anon.

Food Trade Review 39 (11) 43-46 (1969) [En]

The Cadbury-Schweppes new factory at Chirk, Denbighshire is described. It is the world's largest self contained cocoa plant, capable of processing nearly 80 000 tons of beans/yr, has a floor space of 150 000 ft<sup>2</sup>, consists of a main processing building, a solvent extraction plant, boiler house and bean intake section, and cost £4½ million to build. 140 lb sacks of cocoa beans arrive at the receiving deck (which handles 40 tons/h), pass to 2 concrete silos (700 ton capacity/silo) for storage and are distributed to 4 cocoa liquor processing lines. The beans pass through the following process stages: bean cleaning, bean roasting, bean winnowing, nib grinding and pressing of cocoa liquor formed to produce cocoa cake (8-25% cocoa butter). Methods of production of cocoa powder (pulverized cocoa cake), Drinking Chocolate (mixture of cocoa and sugar agglomerated together), Bournvita (malt, glucose, cocoa and sugar) and cocoa butter, are described. VJG

3 L 165

Sweet syrups.

Walton, R. G. P. (Corn Products Co.)

United States Patent 3 475 216 (1969) [En]

(1969) [De]

Sweet syrup is produced by isomerization of dextrose. Deanionization of a starch conversion



syrup by electrodialysis or ion exchange, prior to isomerization, permits the production of sweet syrups having improved properties. IFT

4 L 275

Microbial production of xylitol from glucose.

Onishi, H.; Suzuki, T.

Applied Microbiology 18 (6) 1031-35 (1969) [23 ref. En] [Noda Inst. for Scientific Res., Noda-shi, Chiba-ken, Japan]

A microbiological method is described for the production of xylitol, which is used as a sugar substitute for diabetics. A sequential fermentation process yielded 9.0 g of xylitol from 77.5 g of glucose via D-arabitol and D-xylulose. *Candida guilliermondii* var. *soya* (ATCC 20216) consumed 5.1 g of D-xylulose and produced 2.8 g of xylitol per 100 ml. Pentitol production from D-xylulose by yeasts was divided into 3 types: (i), yeast-produced xylitol; (ii), yeast-produced D-arabitol; and (iii), yeast-produced xylitol and D-arabitol. D-Xylulose, but not glucose, was dissimilated to xylitol by yeasts under aerobic conditions. AS

5 D 311

Ice cream: Schedule of the regulations. 2.

Belgium.

Anon.

Naarden Nieuws 20 (208) 7 (1969) [En]

Belgian food regulations of 1949, 1961 and 1968 relevant to ice cream and water ice are presented in tabular form. Information given includes: % composition of milk fat, other fats, milk solids, sugar, dextrose, glucose syrup and DM; requirements regarding bacterial count, sp. gr., protein content, preservatives, sweetening agents, flavours, colouring agents, emulsifiers, thickeners and gelling agents; and labelling (contents, lettering, reference to milk, eggs, chocolate and fruit). RM

5 J 436

[Effect of glucose on the colour of preserves from fruits containing anthocyanins.]

Andreotti, R.; Fiorentino, M.; Franco, F.

Industria Conserve 44 (4) 300-05 (1969) [17 ref.

It, fr, en, de] [Sta. Sperimentale per l'Ind.

delle Conserve Alimentari, Parma, Italy]

Data are presented showing that glucose, either as commercial corn syrup or 99.9% pure dextrose, efficiently protects the colour of fruit preserves. Best results are obtainable with strawberry, raspberry, plum, and black cherry products, the average difference in pigment retention being 7-8% with max. of 16% for plums and 30% for raspberries. Colour differences between natural preserves and those containing glucose strongly decrease after 8 months storage at 18°C, or after 4 months at 37°C. CEB

5 L 303

The manufacture of caramels. II. Processes and typical recipes.

Ingleton, J. F.

Confectionery Production 35 (12) 787-88 (1969) [En]

The main processing stages are outlined; warm mixing or ultrasonic mixing at the pre-mix stage, followed by cooking in open pans or scraped film evaporators. It is also possible to cook the mix by a steam injection procedure. The effects of

using glucose syrup of a high dextrose equivalent or high maltose content, and the effects of various proportions of milk solids are outlined, and a recipe is given for a good quality caramel. The article concludes with a range of analytical figures for caramels of various milk solids content, and a synopsis of methods for determining these figures. [For Part I see FSTA 1970 2 3L167]. BFMIRA

5 P 558

Method of manufacturing milk products.

Schuler, R. (EVOG, Etablissement für Verwaltung und Organisation)

Canadian Patent 829 840 (1969) [En]

A yoghurt-type product can be produced by ad 0.1-0.5% by wt. yeast extract to milk, which is sterilized before inoculation with 10% by wt. *Lactobacillus bifidus* culture and incubated at 37-40°C for 6 h. The yeast extract, which can be in the form of yeast cell juice or dried yeast reconstituted in milk, is said to shorten considerably acidification and coagulation times without detrimental effect on the taste of the product. Coagulation times can be shortened further by addition of ~1-5% by wt. glucose. *L. acidophilus*, *L. bifidus* and the slow-growing *L. curvatus* and *L. coryniformis* can also be used. H

5 S 414

[Process for manufacturing hard sausage, especially salami.] Verfahren zur Herstellung einer Hartwurst, insbesondere Salami.

Oelsner, W.

East German (DDR) Patent 67 864 (1969) [De]

[Döbeln, E. Germany]

The surface of the raw sausage is treated at 18-20°C with a solution of 15% potato starch, 2.5% glucose or barley malt, 37.5% oil, 37.5% milk and 7.5% alcohol. The sausage is then dried for 5-6 wk and then treated at 35°C (e.g. on the water bath) with a coating that can 'breathe'. To prepare this coating 50 g dried aspic is dissolved in cold water, brought to the boil, cooled to 40°C and added to a prepared mixture of 150 g milk, 150 g oil, 50 g alcohol and 300-350 g fine chalk. The whole is stirred until the coating can be spread. The process guarantees even ripening of the raw sausage. The effect of the coating is that during ripening only water is lost and not the aromatic meat juices. Wt. losses of treated sausages are 5% less than those of untreated, ripened sausages. IN

6 H 730

Sweetened beer.

ABM Industrial Products Ltd.

British Patent 1 174 619 (1969) [En]

Beer from which all yeast has been removed is mixed with the enzyme amyloglucosidase and stored to convert unfermentable carbohydrate to glucose, after which the enzyme is inactivated.

6 L 368

Aerated candy formulas helped by cereal solids.

Stella, D. F.

Candy Industry and Confectioners' Journal 134 (22, 34, 38 & 48 (1970) [En]

The use of hydrolysed cereal solids in aerated confections and an anhydrous dextrose in chocolate bars and coatings is discussed. The former is used to replace 15-50% of gelatin in



marshmallow or albumen in nougat, and the dextrose is used to replace some of the sucrose in chocolate, thereby allowing less cocoa butter to be used. Formulae for their use are included. BFMIRA

734  
[calculating ice cream recipes.]  
[unsholt, K.]  
[ieriposten 59 (4) 68-75 (1970) [4 ref. No]  
[Compositional tables are given for ice cream recipes satisfying Norwegian dairy ice cream requirements of DM content of >28% and containing either sucrose (2-15% as sole sweetening agent with whole milk, butter and dried skim-milk as dairy ingredients), or dextrose (20% of total sugar DM, with the same dairy ingredients), or sucrose syrup (20% of total sugar DM, with the same dairy ingredients or with whole milk, 35% fat cream and dried skim-milk or with skim-milk, butter and dried skim-milk as dairy ingredients). The data were obtained by use of a computer. HBr

G 290  
[coating compositions.]  
[ock, S. P.; Roth, H.; Sommers, J. E. (DCA Food Industries Inc.)  
[Canadian Patent 833 486 (1970) [En]  
[Particulate coating compositions comprise mixtures of sugars selected from the group consisting of dextrose, lactose and sucrose; starch; shortening and water-insoluble waxy materials selected from the class consisting of paraffine, powdered edible fats, waxes and salts of fatty acids. IFT

L 411  
[Gelatin products.]  
[non.]  
[revue des Fabricants de Confiserie, Chocolaterie, Confiserie, Biscuiterie 45 (2) 35 & 39-43 (1970) [r]  
[Evaluation of gelatin for use in sweets production and gelatin properties are mentioned in France, commercial food gelatins generally have 'Bloom' numbers of 150-200). Practical advice is given on preparation of sucrose and glucose solutions and addition of the pre-swollen gelatin. Some formulations for producing soft and hard gelatinized sweets are given. IF

L 435  
[Special nut crunch with peanuts (peanut-brittle).] [Spezial-Knusper-Krokant mit Erdnüssen (Erdnuss-Krokant).]  
[non.]  
[kakao und Zucker 21 (7) 380 (1969) [De]  
[6 kg refined sugar, 0.5 kg brown sugar, 2 kg confectioner's glucose, 1.5 l. water, 300 g solid fat and 300 g antioxidant are heated to 110°C, then 3 kg groundnuts are added and the mixture stirred until the nuts are roasted golden-brown in colour. 20 g salt is added and the batch removed from the heat. 100 g NaHCO<sub>3</sub> is finely sieved and incorporated in the mixture and the resultant mass immediately spread to the desired thickness on an oiled slab. While still flexible the slab is rolled and cut into portions. IN

7 M 620

Soy protein products in commercial cake formulations.

Turro, E. J.; Sipos, E.

Bakers' Digest 44 (1) 58-64 (1970) [En] [Res. Lab., Chemurgy Division, Central Soya Co., Chicago, Illinois, USA]

Expt. on the use of a specially prepared soy flour [Bakers' Digest (1968) 42 (6) 44-50 & 61] as a replacement for nonfat dry milk (NFDM) at levels of 50, 75 and 100% in batch-produced pound cake, devil's food cake, yellow layer cake and sponge cake are reported. Variables introduced by the use of different shortenings, adjustment of water absorption, introduction of dextrose, and increase in leavening were also studied. Soy flour contained 5.40% moisture, 0.56% fat, 60.0% protein and 3.0% fibre as against 7.87, 1.0, 34.0 and 0% respectively for NFDM. Successful replacement at all levels was achieved without deleterious changes in cake quality. At levels of 50% replacement, no formula changes were necessary, except for increased water absorption of  $1.5 \times$  soy flour wt. Replacement levels at or above 75% necessitated the inclusion of dextrose (except in devil's food), and an increase in leavening to obtain the desired vol. Total yearly savings on production of  $5 \times 500$  lb batches 5 days/wk using a 50% replacement were calculated as \$7286. PEG

8 L 508

[Twenty years of confectionery and chocolate progress. From the Proceedings of the 1947 to 1966 Annual Production Conferences of the Pennsylvania Manufacturing Confectioners' Association. [A book] Pratt, C. D.; Vadetzsky, E. de; Langwill, K. E.; McCloskey, K. E.; Schuermann, H. W. (United States of America, Pennsylvania Manufacturing Confectioners' Association) (Editors) xv + 775pp. (611-775) (1970) [Numerous ref. En] Westport, Connecticut: AVI Publishing Co. Inc. Price \$15.00 (US) \$16.00 (Foreign)

[Plastics films for candy packaging (1965), by J. E. Ericson (pp. 611-17); Shelf-life and storage: Sorbitol in candy (1953), by S. T. Cross (pp. 618-34); Some aspects of the shelf-life of candies (1958), by C. L. Hinton (pp. 635-46, 5 ref.); Starch: The use of starch in the confectionery industry (1948), by J. M. Krno (pp. 647-55); Moisture equilibrium in confectioners moulding starch (1950) by F. H. Brock (pp. 656-60); The behaviour of the starch molecule and new developments (1963), by K. S. Ronai & R. M. Boettger (pp. 661-69, 4 ref.); Sugars: Invert sugars (1947), by J. A. King (pp. 670-75); Dextrose and its characteristics (1950), by J. M. Krno (pp. 676-83, 9 ref.); Calculations for use with sugar products (1956), by L. Lang (pp. 684-89); Sweetness and flavouring: Effects of certain physical properties of confectionery products upon their taste (1961), by E. R. Pariser & E. L. Wick (pp. 690-98); Whipping agents: Whipping agents (1948), by G. T. Carlin (pp. 699-706). The second part of the book (pp. 707-64) consists of abstracts, grouped under section headings similar to those used in part one. A subject index is included. JA

8 S 678

[Soluble meat powder.]

[Gharier-Vadrot, P.]



French Patent 1 568 051 (1962) [Fr]

Boned and chopped meat is cooked at 100°C in 10-30% (by wt. of meat) water. The water/meat mixture contains/kg  $\geq 1$  of the following (wt. tolerance  $\pm 30\%$ ): weak acid, e.g. acetic or citric (1.5 g); antioxidant, e.g. ascorbic acid (0.2 g); surface-active agent, e.g. sucrose stearate (0.5 g); vegetable or marine colloid, e.g. gum arabic (120 g); binder, e.g. monosodium glutamate (3.0 g); potassium or sodium nitrate (0.3 g); glucose (10 g). 30-60% of the additives are added before cooking and the balance afterwards. The meat and soup-like product are then crushed finely at 50°C to produce a pasty liquid phase with the meat in suspension. This phase is pressurized and fed into a column, where it is vaporized. The fine droplets are projected into an air current at 150-220°C (on input), which causes rapid evaporation of water droplets and precipitation of powdered solids and crystallized liquids. The air current carries this powder towards a separator where it is collected. Flow rates of air and aqueous solution are so adjusted that the humidified vent air from the separator is at 65-110°C, preferably 85°C. W&Co

9 A 283

**Studies on the taste of some sweet substances. I.**

**Measurement of the relative sweetness. II.**

**Interrelationships among them. [A lecture]**

Yamaguchi, S.; Yoshikawa, T.; Ikeda, S.;

Ninomiya, T.

**Agricultural and Biological Chemistry 34 (2) 181-97 (1970) [17 ref. En]**

The relative efficacy of the following substances in eliciting equal taste intensity was examined: (i) D-fructose, (ii) D-glucose, (iii) D-xylose, (iv) D-sorbitol, (v) D-xylitol, (vi) D-mannitol, (vii) sodium cyclamate, (viii) sodium saccharin, (ix) glycine, (x) DL-alanine and (xi) D-tryptophan. A panel of 100 persons was employed, and sweetness of test samples of a given concn. was related to concn. of (xii) sucrose required to give equivalent sweetness. Quantitative relationships between sweetness and concn. were established and substances classified according to the shape of their taste intensity curves.

Identical taste intensity patterns were found within the group (xii), (i) and (vii), and within the group (ii), (iii), (iv) and (vi). Precise definitions of the interactions of tastes (additive, mixing, suppressing, counteracting and synergistic) are given. In the substances tested, additive, mixing and synergistic effects were found, but no suppressing or counteracting effects. Interrelation among sugars was mostly additive; synergistic effect was observed between (xii) and (i) or (v), also between (viii), (vii) and some sugars. Results are summarized graphically and in tables. A mathematical expression of the synergistic effect was also applied to mixtures of (vii) with (xii), (v) or (viii). RM

9 H 1017

**[Fruit juices. VIII. Heat concentration.]**

Martinez, A. G.

**Ion (Madrid) 29 (339) 563-74; (341) 714-20 (1969)**

[Es]

The dependence of the stability of conc. fruit juices on equilibrium RH (ERH) is discussed. Since normal prevailing ERH does not prevent development of the common contaminants *Aspergillus glaucus*, osmophilic yeasts, *Saccharomyces rouxii* Boutroux, the effect of lowering ERH by adding low mol. wt. osmotically active natural compounds was investigated. Amounts of NaCl between 10 and 20% (T) were added to tomato concentrate containing 25-65% soluble solids (S) and the product inoculated with *Sacch. rouxii* and stored at 28°. A straight line relationship between T and S which prevented fermentation was derived. The technique could be extended to combine the effect of several additives (e.g. NaCl + acetic acid) to achieve better flavour. Results of triangular taste tests of addition of salt, fructose and acetic acid are tabulated. Effects of sucrose, glucose and glycerol on ERH are tabulated. Stability was increased by deionization, carried out by treating the concentrate at 80°C with a cation exchange resin contained in a bag. With this treatment, vitamin C was preserved without chemical preservatives. The concn. of deionized centrifuged juice and its subsequent homogenization with solids is recommended for industrial production of stable high-quality products. The following types of evaporators are described: (1) climbing film, climbing and falling film, horizontal and falling film, and also a vapour pump for operation at low temp.; (2) tubular heat exchanger with forced circulation, submerged tubes and large vertical tubes; (3) vertical with agitated thin film, the last described in detail. Economies associated with multiple effect evaporators are discussed. The price, maintenance, useful life and operation variables of the different evaporators are compared. RM

9 M 796

**[Method for producing bread crumbs.]**

Brouwer, W.; Reinders, M. A.; Leertouwer, M. A.

(Coöperatieve Verkoop- en Productie-Vereniging van Aardappelmeel en Derivaten AVEBE GA)

**Netherlands Patent Application 6 807 072 (1969)**

[Nl]

Bread crumbs for industrial use, e.g. in the manufacture of croquettes, fish fingers and the like, is produced by roasting meal or flour, which can be mixed with starch if required, adding a relatively small amount of water and drying the mixture on a drum drier. The roasting process is preferably carried out in a fluidized bed at 110-200°C. 15-200 parts by wt. water are used/100 parts of roasted product. Soya meal, dextrose and/or flavourings may be added to the mixture before drying. The starting material may consist of 60-100 parts by wt. wheat meal and 0-40 parts by wt. starch. W&Co

10 D 851

**Standard for fruit: frozen.**

Canada, Committee on Processed Fruit and Vegetables

**Canadian Government Specifications Board 32-GP-278**

3pp. (1970) [En] Ottawa: Dept. of Supply and Services. Price 15 cents

This standard, issued in Jan. 1970, lists the styles in which the following frozen fruits



shall be supplied: apples, apricots, blackberries, blueberries, cherries, fruit cocktail, fruit salad, loganberries, cantaloupe melons, peaches, raspberries, rhubarb and strawberries. Frozen fruit shall be supplied in 3 classes: with sugar, invert sugar, dextrose or glucose in dry form; in liquid form; or without sugar, and in 2 grades, Canada Fancy and Canada Choice. Requirements include: that the quick-freezing process shall not be regarded as complete until the product temp. has reached  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) at the thermal centre after thermal stabilization. VJG

11 H 1213

[Soluble powders of fruits and vegetables.]

Charier-Vador, P.

French Patent 1 568 929 (1969) [Fr]

Juice is pressure extracted from fruits, vegetables or parts of plants, leaves or flowers being treated by decoction or infusion at  $45^{\circ}\text{C}$ , followed by application of pressure. After coarse filtration, the following are added: 1-12% glucose, 0.5-6% gelatine, 0.1-2% vegetable colloid, such as gum arabic, 0.01-0.3% dilute acid, such as citric acid, and 0.01-0.3% monosodium glutamate. The liquid phase may be pre-concentrated under vacuum at  $\leq 45^{\circ}\text{C}$  and then spray dried. The resultant powder is soluble in warm water and contains a strong conc. of aromatic cells and micro-organisms extracted from the juice. It is easily stored at room temp. in a dry atm. W&Co

11 K 114

Cocoa product.

Bensdorp GmbH

British Patent 1 189 058 (1970) [En]

Finely divided cocoa compositions contain  $\leq 10\%$  maltose and  $\leq 20\%$  of a monosaccharide such as fructose or glucose. IFT

12 H 1315

Correct type of flavour to use and its correct usage. The soft drinks industry.

Anon.

Flavour Industry 1 (5) 309-12 (1970) [En]

Consideration is given to the following soft drink raw materials, their quality and influence on the final flavour: sweeteners (sucrose, dextrose, liquid glucose, invert sugar, fructose, saccharin); acidifiers (ascorbic, citric, tartaric, phosphoric, malic acids); colours, water and  $\text{CO}_2$ . This is followed by a description of the actual manufacturing processes, with emphasis on the types of flavouring used.

Lemonade, raspberryade, dry ginger ale, tonic water, lime juice cordial, ice cream soda, and fruit squashes are considered. VHG

12 L 789

[Storable fondant.] Verfahren zur Herstellung von haltbarer Fondantmasse.

Deutsche Maizena Werke GmbH

West German Patent Application 1 299 990 (1969)

[De]

Fondant from dextrose and glucose syrup has high DM content and added hexitol, e.g. sorbitol; it is cooled and matured, then warmed to  $20-50^{\circ}\text{C}$  and mixed uniformly with water-free

fusion of edible hexitol or pentitol, and cooled to room temp. W&Co

12 L 865

Glucose syrups in food.

Palmer, T. J.

Process Biochemistry 5 (5) 23-24 (1970) [En]

[Tunnel Refineries Ltd., Thames Bank House, Tunnel Avenue, London, S.E. 10, England]

Applications of glucose syrups (GS) in the food industry are described, including:

control of fp of ice cream; prevention of staling of bakery products; production of rapidly-fermenting doughs; manufacture of jam; prevention of crystallization of sucrose in jellies and boiled sweets; improvement of texture of confectionery; improvement of colour of cakes; and use as foam stabilizers, flavour enhancers, binding agents, bodying agents, emulsifying agents, preservatives, sweeteners and digestible energy sources in dietetic and infant foods. Properties of GS, which depend on the dextrose, maltose, higher sugar and dextrin content, may be controlled by termination of the hydrolysis of starch at predetermined stages. AJDW

12 S 1154

[A note on the effect of coating on lipid oxidation of freeze-dried foods.]

Fujio, H.; Hiyoshi, A.; Asari, T.; Suminoe, K.

Journal of Food Science and Technology (Tokyo) 15 (10) 471-73 (1968) [6 ref. Ja, en] [Dept. of Agric. Chem., Univ. of Agric., Setagaya-ku, Tokyo, Japan]

Coating with glucose, arabinose, starch, or sodium aspartate was effective in retarding the lipid oxidation of freeze-dried pork, although the process requires freeze-drying of the food again after dipping into the solution of the coating material. HE



## VOLUME 3

1 L 23

**Use of dextrose in sweet manufacture.**

Ingleton, J. F.

**Confectionery Production 36 (8) 473-74 (1970) [En]**

The use of dextrose in sugar confectionery is four-fold: (i) to promote crystallization; (ii) to produce a small crystal size in the solid phase; (iii) to produce a more tender product; (iv) to produce a particular taste sensation. 3 forms of dextrose are available with slightly different solubilities. Their properties and characteristics are described and a specification given. The use of dextrose at levels of 5-15% in fondants, creams, fudge, turkish delights, nougat, marshmallows, sherbet and lozenges is mentioned. BFIMIRA

1 T 49

**[Process for production of an edible gelling agent, in particular for producing jams, etc.]**

Fabrikationsverfahren für ein Produkt zum Erhalt von Gelen, insbesondere für Nahrungsmittel und speziell für eine schnelle Herstellung von Marmeladen und andere Anwendungen, und mit diesem Verfahren hergestellte Produkte

Charriere, R. T. (Unipeptine SA)

**West German Patent Application 1 922 513 (1970)**

[De]

A gelling agent of improved quality is produced by a simplified process. Sugar, sucrose, glucose or a similar substance having a crystal size of 0.6-0.8 mm is moistened with 0.4% water before mixing with 0.2-3.0% pectin. The mixture is subsequently dried at 60°C in a partial vacuum, and 0.4-0.8% crystallized acid, e.g. citric acid or tartaric acid, is added. Optionally, polyvalent cations, neutralizing salts, buffering agents etc. may also be added. The product is packed in moisture-proof bags and has an unlimited shelf-life. W&Co

2 L 161

**Some effects of consuming glucose syrups. (In "Glucose syrups and related carbohydrates".) [A symposium]**

Macdonald, I.

pp. 86-92 (1970) [12 ref. En] London, UK: Elsevier Publishing Co. Ltd. [Dept. of Physiol., Guy's Hospital Med. School, London SE 1, UK]

The properties of glucose syrups that differentiate them from other dietary carbohydrates are their low levels of both sweetness and osmotic pressure. Therefore, large quantities can be taken without nausea arising from psychological or physical causes. The rate of absorption into the blood of the glucose from glucose syrups is of the same order as that found when glucose per se is given. When compared with sucrose, the usual sweetener in the diet, glucose syrups have some advantages, which include the absence of the rise in serum lipids seen after

high sucrose diets, and a smaller amount of fat laid down in the liver. When combined with saturated fats, such as cream, there is less likelihood for the serum lipids to rise than when sucrose accompanies the cream. In expt. animals the amount of depot fat produced by glucose syrup in the diet is less than that produced by sucrose. AS

2 U 75

**Ketchup.**

Israel, Standards Institution

**Israeli Standard S.I. 524 5pp. (1969/) [En]**

[University Street, Tel Aviv, Israel]

This is an English translation of the standard, originally published in Hebrew, which came into force in Dec. 1969, superseding the earlier version of May 1964. It applies to the product obtained by squeezing of fresh tomatoes, and/or tomato juice, tomato puree, or tomato paste with the addition of all or some of the following substances: salt, white sugar, glucose syrup, vinegar or acetic acid, other acids, concentrate of pasteurized lemon juice, spices, stabilizers. Requirements cover preservation, packing, marking, sampling, filling, testing (vacuum, soluble solids content, salt content, metal content, pH, absence of insects, moulds), and test methods. JA

2 U 127

**[Cooked smoked sausage: quality requirements for attested product.]**

Union of Soviet Socialist Republics, Komitet Standartov, Mer i Izmeritel'nykh Priborov  
Soviet Standard GOST 5.537-70 7pp. (1970) [Ru]

[Moscow, USSR]

This standard, which came into force on 1 June 1970, covers 'Moskovskaya' cooked smoked sausage awarded the state mark of quality. Quality and compositional standards for sausage meat include: dressed higher-quality beef, 75 kg/100 kg; pig backfat, 25 kg/100 kg; other ingredients (g/100 kg), salt 3000, sodium nitrite 5, sucrose or gulcose 200, black pepper 150, nutmeg or cardamom 30. Quality and compositional standards for the sausage include: moisture content, for local consumption,  $\leq 42\%$ , for distribution  $\leq 38\%$ ; salt content,  $\leq 4.5\%$ ; sodium nitrite content,  $\leq 5$  mg/100 g. Regulations on manufacture, organoleptic assessment, analysis, packaging, labelling, transport and storage are listed. SKK

3 J 300

**[The use of hydrolysis products in fruit preserves.] Der Einsatz von Verzuckerungsprodukten bei Obstkonserven.**

Thieme, E.

**Industrielle Obst- und Gemüseverwertung 55 (16) 459-61 (1970) [De]**

The make, sweetening capacity and chemical characteristics of glucose syrups of high and low degrees of hydrolysis are reviewed. Expt. are reported on the production on a commercial scale of strawberry and pear preserves using glucose syrups (25, 30 and 40%) and strawberry and plum preserves using dextrose syrups (0, 20, 30, 40 and 50%) in comparison with products made with sucrose syrup. Samples were stored for 18



months at 15°C. No differences in colour, consistency or taste were found. For light syrups additions of  $\leq 30\%$  of dextrose or glucose syrup were judged favourable for the products; higher quantities showed unfavourable reduction in sweetness and in sweet/acid relation. For heavy syrups the reverse was found: large quantities of dextrose or glucose syrups gave best results. Legal (W. German) aspects of the matter are discussed. JMS

3 L 222

[Application of glucose syrup in confectionery.]

Talpaert, D.

Revue des Fabricants de Confiserie, Chocolaterie Confiturerie, Biscuiterie 45 (10) 22, 25, 29, 31, 33 & 35 (190) [Fr]

Glucose syrup is a major material used in confectionery. Modern methods used in production of glucose syrup are described. Glucose syrups are now made by controlled hydrolysis of starch, especially corn starch, using dil. mineral acid and/or enzymes. Use of different enzymes ( $\alpha$ -amylase,  $\beta$ -amylase, glucoamylase) which catalyse hydrolysis of starch at specific points in the molecule permits a better definition of the type of syrup produced and allows manufacture of new types of syrup. The degree of hydrolysis is defined by the DE value (dextrose equivalent) and syrups used in confectionery are commonly in the range 26-55 DE. The starch hydrolysate is purified by filtration and treatment with activated C and conc. by evaporation to 43-45 Baume. Composition and physico-chemical properties of glucose syrups made by acid or enzymic hydrolysis together with their use in manufacture of various confectioneries are tabulated. AH

3 L 223

[Influence of glucose syrup on the structure and physical properties of heated sugar.]

Anon.

Revue des Fabricants de Confiserie, Chocolaterie, Confiturerie, Biscuiterie 45 (9) 22, 24, 27, 31 & 33 (1970) [Fr]

Reference is made to the complex physical structure of heated sugar sweets, comprising a mixed crystalline and non-crystalline structure, and in the case of caramels a dispersion and emulsification of fats and migration of protein particles. The mass must be fluid at temp. of 120-150°C during cooking, but develop high viscosity below 120°C and solidity as a stable vitreous structure. Data of physical properties (viscosity, hardness, resistance to cracking) for mixtures of sucrose and glucose syrup of different DE values (dextrose equivalent) at temp. from 100 to 147°C are tabulated. Increasing incorporation of glucose syrup has little effect on viscosity at high temp. but augments it at low temp., especially with low DE syrup. Shear resistance of the molten mass is improved and fragility of finished portioned sweets is reduced by increasing syrup incorporation and increasing DE, particularly with enzyme type syrups. Speed of solubilization is little affected by the type of syrup. ELC

3 L 239

[Seeding suspension for forming saccharose crystals in a sugar solution.]

Tiele, H.; Doering, T. von; Wegner, G. (Pfeiffer and Langen)

USSR Patent 269 072 (1970) [Ru]

Suspension consists of a carrier solution and an additive containing saccharose microcrystals. To improve crystal formation and ensure their correct shape, the carrier solution and the additive contain a glucose solution having 84% dry substances and a solution saturated at 20°C having 66.6% dry substances. The carrier solution and the additive each preferably comprise 50% by wt. The carrier solution can contain 40% glucose solution, and 60% saturated saccharose solution, while the additive can contain 30% glucose solution, and 70% saturated saccharose solution. W&Co

3 M 299

[Use of sucrose and dextrose sugars and malt extract for breadmaking.]

Coppo, V.; Genotti, G.

Tecnica Molitoria 20 (24) 693-96 (1969) [It, en]

[Lab. Chimico, Gab. sperim, Scuola Arte Bianca, Turin, Italy]

Amounts of gas evolved during dough fermentation and of reducing sugars present in bread were determined in a study of the influence of adding sucrose, dextrose, and malt extract to flours for breadmaking. Fermentation was improved with respect to the amount of gas produced and gas development time was extended. Physico-organoleptic characters of the bread were improved, particularly with additions of malt. Additions should be of the order of 1-2% with respect to flour in order to prevent development of a distinct sweet taste. CEB

4 H 509

[Process for preventing chill haze in beer, and product used in this process.]

Verfahren zur Vermeidung von Kalttrübung in Bier, und Produkt zur Anwendung bei diesem Verfahren.

Ceuster, P. de

West German Patent Application 1 517 872 (1970)

[De]

Proteolytic enzymes preventing chill haze remain active for a longer period if they are added to the beer in a clear ficin-solution containing antioxidants e.g. potassium metabisulphite, and hydrophilic substances e.g. glycerine, glycol, glucose syrup, fructose or sucrose. A typical mixture is 5% ficin, 3% potassium metabisulphite, 22% water and 70% glycerol. W&Co

4 H 532

[Process for debittering aqueous malt germ extracts.]

Verfahren zum Entbittern von wässrigen Malzkeimauszügen.

Vosseler, O. (Phönix-Brauerei GmbH)

West German Patent Application 1 517 849 (1970) [De]

Malt germs are extracted with water in a ratio  $>1:10$ , in particular 1:3 to 1:6, at between room temp. and bp. The extract is mixed with  $>10$  wt.%, preferably 20-30 wt.%, mono- or disaccharides, e.g. sucrose, maltose and glucose, and heated for 30-300 min at 50-95°C. The substance may then be conc. by evaporation and used for producing drinks. No valuable vitamins etc. are destroyed. W&Co



4 H 597

Soft drink compositions.

Stokely-Van Camp Inc.

British Patent 1 204 055 (1970) [En]

The invention describes soft drink compositions which can be diluted with water to form a beverage and which contain specified quantities of glucose and Na ions. IFT

4 L 296

[Extending the range of non-chocolate milk sweets. Technology of manufacture of rum "lakta".]

Vakrilov, V.; Penev, P.

Nauchni Trudove. Vissh Institut po Khranitelna i

Vkusova Promishlennost 16 (1) 203-08 (1969) [4

ref. Bg, ru, fr] [Vissh Inst. po Khranitelna i

Vkusova Promishlennost, Plovdiv, Bulgaria]

Tests with various recipes for milk toffees with rum are reported. The chosen recipe was (kg/100 kg finished product): granulated sugar, 55.401; glucose syrup, 24.567; butter, 8.160; condensed milk, 22.012; cocoa powder, 1.008; rum, 2.0; rum flavouring, 0.060. Boiling was at  $-127^{\circ}\text{C}$ . Exports of the new toffee to W. Germany amounted to 300 tons in 1966/67. SKK

4 L 317

[Agglomerierte Zuckerprodukte.

Nelson, A. L.; Skrabacz, D. T.; Young, B. (C P C International Inc.)

West German Patent Application 1 951 460 (1970)

[De]

Crystalline sugar, e.g. dextrose, sucrose, lactose, or mixtures thereof, is mixed with 1-10 wt.%, preferably 2-4 wt.%, of a starch hydrolysate with a dextrose equivalent (DE) of 5-25, preferably 10-15. The hydrolysate contains  $<5\%$  water and has a descriptive ratio [i.e. (sum of saccharide) - (% with 1-6 degrees of polymerization) : (DE)] of 2. The mixture is then dried. The obtained agglomerate consists of free-flowing, uniformly sized particles which are suitable for confectionery products and dragees, as they are easily compressed. W&Co

4 N 184

[Oil improvement.]

Anjinomoto Co. Ltd.

Japanese Patent 28 899/70 (1970) [Ja]

Oils and fats are improved by incorporating mixtures of leucine, xylose, valine and glucose. IFT

5 G 160

[Coating for food products.] Überzug für Nahrungsmittel.

Lipka, D. H.; Finkel, G. (DCA Food Industries Inc.)

West German Patent Application 1 517 013 (1969)

[De]

A granulated coating material for foods to be fried, e.g. fish, shrimps, poultry, meat and vegetables, which is particularly suitable for frozen food, consists of particles having a 3-dimensional fibre structure of gluten-containing protein, in which non-gelatinized starch is finely dispersed. The coating material is produced by mixing the starch with  $\geq 2.2\%$  active gluten (by wt. of solids) and 23-43% water (by wt. of mixture). The mixture is worked sufficiently to form an agglomerate, in which the gluten is

present in the active, fibrous state. The agglomerate is pelletized and dried to a water content of  $\leq 12\%$  without gelatinizing the starch. 2-15% by wt. of a fat material may be added to the granulate. Wheat flour and water are the preferred basic ingredients. Glucose, dried skim-milk, spices, and salts, e.g. acidic pyrophosphate and bicarbonate of soda, may be added. The material is applied to the frozen food product and becomes tender and dry during heating. W&Co

5 G 179

[Studies on utilization of soya bean protein for food manufacture. II. Influence of soya milk added to skim-milk on the acidity and the hardness of curd produced by lactic acid bacteria for dairy use.]

Yamanaka, Y.; Furukawa, N.

Journal of Food Science and Technology [Nihon Shokuhin Kogyo Gakkai-shi] 17 (10) 456-61 (1970) [12 ref. Ja, en] [Dept. of Zootechnical Sci., Univ. of Agric., Setagaya-ku, Tokyo, Japan]

Cultured milk products from combinations of skim-milk and soya bean milk were studied by inoculating pasteurized samples with lactic starter cultures and measuring the acidity and the degree of curd hardness after 8 h of incubation at 30 or  $37^{\circ}\text{C}$ . The viscosity of 10% dispersions, in the range  $63-80^{\circ}\text{C}$ , increased markedly at  $80^{\circ}\text{C}$ . With 6 cultures of lactic acid bacteria, after 8 h of incubation, the acid production tended to be higher in certain combinations of the 2 milks than in skim-milk alone, except for 1 culture. In soya bean milk, acid production by *Streptococcus faecalis*, *Str. thermophilus* and *Str. lactis* increased a little. At soya bean milk conc. of 20-30% (v/v), the curd after storing for 24 h at  $4^{\circ}\text{C}$  was soft; on the other hand, at concn. of 65-75% (v/v), the curd structure formed was considered too hard. Addition of sucrose to 10% dispersions generally lowered the curd tension, but glucose raised the curd tension when *Lactobacillus* was used. HE

5 H 747

[Beverage drying process.]

Japan Jiffy Foods Inc.

Japanese Patent 20 933/70 (1970) [Ja]

Reconstitutable food drink bases are prepared by combining cooled juice pulp with anhydrous glucose to form a gel, which is then dried. IFT

5 H 784

[Process for producing a malt drink substance with neutral flavour.] Verfahren zur Herstellung eines Malzgetränkgrundstoffes mit-neutralem Geschmack. Krabbe, E.; Akin, C. (Falstaff Brewing Corp.)

West German Patent Application 1 517 809 (1970)

[De]

The substance is made by firstly producing an extract comprising 10-35 wt.% unboiled wort and 90-65 wt.% fermentable sugar, e.g. glucose of hydrolysed starch. 4-6 gm of a *Saccharomyces cerevisiae* or a *Sacch. Carlsbergensis*, e.g. brewers' yeast, are added per l. extract. The mixture is fermented at  $16^{\circ}\text{C}$ , cooled to  $\leq 3^{\circ}\text{C}$  and the solid substance from which beverages are produced is separated. Alcoholic beverages may be made by addition of flavourings e.g. coffee, mint, cherry, etc., and  $\text{CO}_2$ . W&Co



5 J 642

[Jellied fruit.]

Uchida, D.

Japanese Patent 26 692/70 (1970) [Ja]

Seasoned fruit compositions and a mixture of carrageenan and glucose are vacuum packaged, heat sterilized while rotating to effect solubilization and uniform dispersion, and finally cooled at 40-45°C as the can is rotated. IFT

5 J 668

[Process for dehydrating green peas.] Verfahren zum Entwässern von grünen Erbsen.

Templeton, R. A. S.

West German Patent Application 1 492 698 (1970) [De]

Peas are blanched in a hot, dil.  $\text{Na}_2\text{CO}_3$  solution at pH 9.0-9.5 and 93-96°C until the surface skin is softened and becomes steam-permeable. Simultaneously or subsequently, the peas are impregnated with a 5-15% sugar solution e.g. sucrose, dextrose, or lactose, for 2-5 min at 66-100°C (preferably 93). They are then dried in hot air to a low moisture content. The sugar, which penetrates the peas, acts as a structural support when dry to retain the capillary system. Reconstituted peas have uniform structure and original shape. W&Co

5 L 342

[Fondant production.] Fondant.

Anon. (Zuckerfabrik Franken GmbH)

Zeitschrift für die Zuckerindustrie 20 (5) 254-55 (1970) [De]

A description is given of a moist fondant, made by a continuous process by the sugar factory Zuckerfabrik Franken GmbH, Ochsenfurt, and sold under the name Franken fondant. The mass is composed of a ~82% refined sugar, ~9% starch syrup or glucose and ~9% water. The ingredients are mixed at constant temp. and vol., stirred and cooled to give a paste of fine sugar crystals. A dry fondant, made from firmly ground sucrose crystals and invert sugar, is also described. IN

5 P 751

[Method and device for preparing a milk-fat-sugar solution.] Verfahren und Vorrichtung zum Herstellen einer Milch-Fett-Zucker-Lösung.

Anders, G. (Hamac-Hansella GmbH)

West German Patent Application 1 293 554 (1969) [De]

A mixture suitable for further processing in a confectionery pan is prepared by pre-heating milk and fat separately, continuously mixing these components and admixing a continuously fed solution of sugar and glucose. Salts, flavourings etc. are added to the milk before mixture with the fat. The pumps which feed the milk and fat to the pre-mixing container are controlled from the machine preparing the solution of sugar and glucose. A homogeneous product, which is of good quality and free from sugar crystals, is obtained even with mixtures having a low milk and fat content. W&Co

5 P 758

[Technology and economics of ice cream.]

Devaux, R.

Industries Alimentaires et Agricoles 87 (9/10)

1145-53 (1970) [Fr, en, de]

Annual per caput consumption of industrially produced ice cream in France is ~2 l. The author outlines the technology of ice cream production and distribution and gives a generalized breakdown of costs. Min. compositional requirements are 7% milk fat and 14% sucrose (25% in the case of fruit ices). Glucose or invert sugar are allowed additionally to a limit of 6%. Gelatin, pectin, sodium alginate, carrageenan and various high mol. wt. sugars are permitted stabilizers; emulsifiers (mono- and polyglycerides) are prohibited. BEPC

5 S 526

Sausage casing release agents.

Cameron, A. H. (Union Carbide (Canada) Ltd.)

United States Patent 3 533 808 (1970) [En]

Cellulose casings have an inner surface impregnated with a release agent selected from sucrose, glucose, lactose and maltose. IFT

5 T 226

[Meat extract substitute and process for its production.] Fleischextrakt-Ersatzprodukt sowie Verfahren zur Herstellung desselben.

Dunn, H. J.; Farr, M. P.; Schleusner, O. (Ralston Purina Co.)

West German Patent Application 1 951 514 (1970) [De]

Fish by-products or waste products, e.g. boiling liquid etc. from tuna, herring, mackerel, etc., are treated to extract fat and condensed. The obtained, soluble fish substance, containing 0.5% fat and 50% TS, is mixed with  $\leq 10\%$  of a reducing sugar, e.g. glucose. The mixture, at pH 6-9, is heated to 82-96°C for  $\geq 4$  h with constant agitation. A brown colour forms, the fish-flavour is replaced by a beef-like flavour, and the product contains 70-80% AS. Application is to sauces, soups, etc. W&Co

5 T ~~226~~ 227

[Process for producing a new aromatic substance.]

Verfahren zur Herstellung von neuartigen Aromen:

Onishi, L.; Kakizawa, T.; Nishi, A. (Yuki Gosei Kogyo Co. Ltd.)

West German Patent Application 1 593 733 (1970) [De]

Amino acids, e.g. glycine, proline alanine, serine, etc., are reacted with sugar, e.g. glucose, and mono- and polysaccharides having an active carbonyl-group, in the presence of a polyhydric alcohol, e.g. glycerin, ethylene glycol, etc. Reaction is effected at 70-90°C until no free amino acids are present. 1-3 wt. % (of the alcohol) amino acid, and 3-15 wt. % sugar are used. The obtained substance has a brown colour and is added to baked products, desserts, etc. W&Co

5 T 232

[Process for production a colouring agent for food products and beverages.] Verfahren zur Herstellung von Färbemitteln für Nahrungsmittel und Getränke.

Samejima, H.; Nagano, Y.; Ota, S.; Kanzaki, Y.; Matsuo, H.; Kuroda, K.

West German Patent Application 1 947 599 (1970) [De]



A colouring agent for beverages, e.g. coke, alcoholic beverages, etc. and baked products, soy, etc. is produced by heating an aqueous solution containing a saccharide, e.g. glucose, fructose, leucate, etc., and a basic amino acid, e.g. glycine, alanine, glutamic acid, etc., the mol. ratio of amino acid to saccharide being 1-5:1, to  $\sim 100-125^{\circ}\text{C}$  at pH 11-13. The obtained reaction solution is de-alkalised either by neutralization with an acid, or by treatment with a mildly acidic cation exchange resin. The resulting product is an improved colouring agent having antioxidizing, O-absorbing and lipoxidase-inhibiting properties. W&Co

6 E 297

[Pelletized powder and process for its production.] Pelletisiertes Pulvermaterial und Verfahren zu seiner Herstellung. Stewart, A. P., Jr. (Allied Chemical Corp.) West German Patent Application 1 492 985 (1970) [De]

Powders are pelletized by incorporation of a binding agent (e.g. dextrose, sucrose, trisodium phosphate), which is then crystallised. Applications of the process include production of non-hygroscopic, free flowing soluble cocoa, instant dried milk and fumaric acid. W&Co

6 G 224

[Food product of high nutritional value.] Nahrungs- und Genussmittel mit hohem Nährwert. Hoffmann, E.

West German Patent Application 1 813 390 (1970) [De]

The product is a powder consisting of (%) 10 lecithin (pure), 20 cocoa substances, 34 dried skim-milk, 35 dextrose and 1 seasoning and flavouring. W&Co

6 H 817

[Studies on the effect of sugar on the glycerol content and the redox potential of wines.] Untersuchungen zum Einfluss des Zuckers auf den Glyzeringehalt und das Redoxpotential des Weines. Liebert, H.-P.

Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, II. Abteilung 125 (3) 289-94 (1970) [20 ref. De, en] [Sektion Biol.-Pflanzenphysiol., Friedrich-Schiller Univ., Jena, E. Germany]

During alcoholic fermentation, fructose produces a higher glycerol yield than glucose or sucrose; the fermentation medium (nutritive medium or grape-juice) has no influence on the final result. The redox potential (ROP) is most negative in fructose fermentation; however, during fermentation of glucose and sucrose the level is markedly higher. Increase in sugar concn. does not cause a linear rise of glycerol yield.

Dependent on the sugar concn., a constant value for ROP will be achieved more or less quickly; during fermentation of larger amounts of sugar however, the lowest values of ROP will be reached within 3 days. The fermentation of the sugar having been completed the glycerol content will decrease again. AS

6 J 700

Determination of blanching conditions for frozen par-fried potatoes.

Brown, M. S.; Morales, J. A. W. American Potato Journal 47 (9) 321-25 (1970) [3 ref. En, es] [W. Regional Res. Lab., Agric. Res. Service, USDA, Albany, California 94710, USA]

Preparation of frozen par-fried potatoes includes a low temp. blanch for partial cooking and leaching of excess sugar, followed by a brief immersion in a glucose solution if needed for uniform colouring during finish frying. Colour of potatoes after frying and their texture before and after frying (measured by shear press) served as criteria for determining suitable blanching time and temp. Blanching temp. of 75, 80 and 85°C were used, samples being removed at 5 min intervals from 5-25 min, one side trimmed to provide a control surface and fried for 3 min at 190°C. Potatoes blanched at 75°C darkened excessively during frying while those blanched at 85°C were too soft. 15 min at 80°C was recommended as optimum blanch. Some peroxidase present after 80°C blanch was inactivated by water blanching for 1 min at 95°C. The best colour was obtained with a 1.5 min blanch in 0.25% glucose solution. RPC

6 J 766

[Sorbital and glucose as anti-browning agents in dried fruits.] Sorbit und glucose als Hilfsmittel zur Bräunungsverhütung an Trockenfrüchten. Stoll, K.

Schweizerische Zeitschrift für Obst- und Weinbau 106 (20) 492-94 (1970) [4 ref. De] [Eidgenössische Forschungsanstalt, Wädenswil, Switzerland]

Portions of apricots, apples and pears were immersed in solutions of sugar (70%), sorbitol (70%) and glucose (70%) for 40 h/20°C or 24 h/40°C and then dried at 65°C in a conventional oven. The fruits were stored at 18-20°C in polyethylene bags and after 12-24 months tested for quality by the Karlsruhe evaluation scheme [FSTA (1970) 2 5A161] using as quality criteria colour and appearance, taste and consistency. Results were compared with those for untreated fruits and fruits immersed in SO<sub>2</sub> solution. Like sugar, sorbitol and glucose inhibited the browning of fruit and showed generally good results. These powerful osmotic agents have low sweetening ability, about half that of beet sugar. JMS

6 L 418

[Seeding suspension containing saccharose for seeding syrup.] Saccharosehaltige Impfsuspension zur Kristallbildung von Zuckerlösungen. Thiele, H. (Pfeifer & Langen)

West German Patent Application 1 567 304 (1970) [De]

Suspension is obtained by mixing 50 wt.% of a carrier solution with 50 wt.% of a fondant. The carrier solution consists of a glucose solution containing  $\sim 84$  wt.% TS and a saturated saccharose solution containing  $\sim 66.6$  wt.% TS. The fondant is obtained by mixing glucose and saccharose solutions (data as above) in the ratio 3:7, condensing it at 116°C, cooling it to 60°C and cooling further in a fondant beater. The obtained seeding suspension consists mainly of uniform, non-polar saccharose crystals (5-10  $\mu$ ) thus preventing conglomerate formation. W&Co

6 L 492

Fructose - the extraordinary natural sweetener.



Freed, M.

Food Product Development 4 (1) 38-39 (1970) [10 ref. En] [Chem. tech. Service, Dawe's Lab. Inc., Chicago, Illinois, USA]

The sweetness of fructose in relation to sucrose and several other natural sugars and sugar alcohols, the effect of temp. on fructose sweetness, the presence of other materials (NaCl, acetic acid) on sucrose sweetness, the relative sweetness of mixtures of dextrose, fructose and sucrose, and some uses of fructose are reviewed. The uses and advantages of fructose-gluconate mixtures with saccharin, and for soft drinks, sour candies and low calorie foods are discussed. AL

6 P 873

Yoghurt - dairy jackpot or football?

Angevine, N. C.

Cultured Dairy Products Journal 5 (2) 6-8 (1970) [En] [American Cultured Dairy Products Inst., St. Louis, Missouri, USA]

The article deals with recent developments in yoghurt manufacture in the USA, describing in some detail low-temp. incubation of yoghurt (at 90-85°F for 12 h) practiced by some US companies and a method for the manufacture of a type of fruit yoghurt, incorporating a mix consisting of milk solids, caseinate, dextrose, carrageenan, gelatin and guar gum. FL

6 P 916

Flavour modifications produced in ice cream mix made with corn syrup. II. CO<sub>2</sub> production associated with the browning reaction.

Eoepochino, A. A.; Leeder, J. G.

Journal of Food Science 35 (4) 398-402 (1970) [37 ref. En] [Dept. of Food Sci., Rutgers - St. Univ., New Brunswick, New Jersey 09803, USA]

Ice cream mixes containing 12.5% fat, 9.5% milk SNF and 16% sweetener were heated in 200 g quantities in sealed cans. The sweetener was varied from only sucrose to mixtures of low or high dextrose equivalent glucoses and sucrose at 40% and 60% replacement levels. The mixes were heated at 71 and 81°C for 4-8 h. The amount of browning reaction was measured by the amount of CO<sub>2</sub> evolved during the heating. Increases in the browning reaction accompanied increases in heating time or temp. The mixes showing most browning at the higher temp. and times were those containing the greatest concn. of reducing sugars. From work done with model systems a simple browning reaction between casein and lactose was ruled out as an adequate explanation for the prolific production of CO<sub>2</sub> in a blank mix (containing only conc. whole milk), and it is suggested this was an unexplained artefact. Potassium bisulphite suppressed the browning reaction in all mixes to a certain extent. It was concluded that corn syrup-associated flavour defects in ice cream mix probably not a manifestation of the browning reaction. [See FSTA (1969) 1 12P1215 for part I.] JR

6 P 951

Ice cream and ice milk. Churning of milkfat made with low dextrose Equivalent corn sweeteners.

Mahdi, S. R.; Bradley, R. L., Jr.

Dairy and Ice Cream Field 153 (1) 140, 142, 144 & 146 (1970) [9 ref. En] [Dept. of Food Sci., Univ.,

Madison, Wisconsin, USA]

In addition to high fat content, low homogenization pressures and temp. and excessive stabilizer, it was discovered that the use of low dextrose equivalent (DE) corn sweeteners may cause churning of fat in the freezer and so bring about a "does not melt" defect. Ice cream mixes containing 12% milk fat, 10% serum solids, 8% sucrose, 8% appropriate corn sweetener and 0.3% gelatin, and ice milks containing 6% milk fat, 12.5% serum solids, 8% sucrose, 8% of the appropriate corn sweetener and 0.5% gelatin were processed and frozen in a batch freezer, and then hardened. 10, 15 and 20 DE maltodextrin, 36 DE regular and 62 DE corn sweeteners were used, together with controls containing 16% sucrose only. It was found that the defect was proportional to the level of substitution of corn sweetener for sucrose and to the fat content, but inversely proportional to the DE of the corn sweetener. The authors state that the corn sweetener polymers became attached to the  $\alpha_1$ - and  $\beta$ -casein which is then adsorbed on the surface of the fat globules. During freezing these complexes were abraded from the surface and large aggregates of fat were formed leading to the defect. JR

6 S 733

[Method for producing a hard sausage, in particular salami.] Verfahren zur Herstellung einer Hartwurst, insbesondere Salami.

Oelsner, W.

West German Patent Application 1 906 243 (1970) [De]

The surface, a raw sausage in a natural casing is coated with an 18-20°C solution of 15% potato starch, 2.5% glucose or barley malt, 37.5% milk and 7.5% alcohol. The sausage is dried for 5-6 wk and an air-permeable substance is then applied to its surface. This substance is obtained by adding 40°C water containing aspic to a mixture consisting of 150 g milk, 150 g oil, 50 g alcohol and ~300-350 g purified, prepared chalk. The resulting sausage has a uniform, hard consistency and good flavour. W&Co

7 L 583

Confectionery ingredients. Composition and properties. VIII. Individual carbohydrates: dextrose.

Cakebread, S. H.

Confectionery Production 37 (3) 140, 142-43, 146-47 & 164 (1971) [En]

Dextrose is discussed in terms of its history and occurrence, composition, form and appearance, manufacture, properties and cooling effects in the mouth. [For part VII see FSTA (1971) 3 6L467.] BFMIRA

7 P 1048

[Sucrose, invert sugar and glucose syrup in ice-cream manufacture.]

Brochu, E.

Quebec Laitier et Alimentaire 29 (9) 6-8 (1970)

[Fr] [Inst. Rosell de Bact. Laitiere, Montreal, Quebec, Canada]

The effect of various sugar mixtures on ice cream quality was studied. Samples were prepared using sucrose with 20, 30 and 40% glucose syrup, 20, 25



and 30% invert sugar and 20, 30 and 40% invert sugar with 10% hydrolysed cereal starch. Evaluation included appearance, flavour, consistency, texture, rate of melting and separation at melting. Using an overall index, best results were achieved with 30, 25 and 20% invert sugar mixtures. RM

7 S 792

#### Sausage casings

Cameron, A. H. (Union Carbide Canada Ltd.)  
Canadian Patent 862 042 (1971) [En]

The release properties of regenerated cellulose sausage casings are improved by impregnation of the inner surfaces with sucrose, glucose, lactose or maltose. IFT

7 U 471

#### Current food additives legislation - Netherlands.

Food & Agriculture Organization

Current Food Additives Legislation 1969 (124) 10-11 (1969) [En] [Rome, Italy]

Decree of 29 July 1968 relating to meat and meat products makes the following amendments concerning food additives: Prepared uncooked minced meat, additives authorized for use in the product are saltpetre (max., 0.2%), nitrous acid (max., 0.05% calculated as  $\text{NaNO}_3$ ) and small amounts of ascorbic, nicotinic and citric acid, sucrose and glucose. Colorants suited to meat and substances whose addition to meat is permitted may also be used; Other meat cuts, the only oils and extracts, spices and flavourings permitted are those which contain only natural flavours and taste enhancers recognized as such by the Minister of Social Affairs and Public Health. [See also FSTA (1970) 2 8D601.] AB

8 E 408

#### [Sterilization and bleaching process.]

Zensoku Kamaboko Suisanka Kogyo Kyodo Kumiai Rengokai

Japanese Patent 36 139/70 (1970) [Ja]

Heated foods are sterilized and bleached by incorporation of aqueous  $\text{H}_2\text{O}_2$  compositions containing compounds selected from glycine, sorbitol, glucose, and artificial sweeteners, along with an organic acid. IFT

8 H 1143

#### Stabilization of cloud in orange squash.

Ranganna, S.; Raghuramaiah, B.

Indian Food Packer 24 (2) 14-21 (1970) [11 ref. En] [Central Food Technological Res. Inst., Mysore-2A, India]

Pasteurized and unpasteurized orange juice was used to prepare squashes containing 25% juice, 45% total suspended solids (TSS), 1.5% acidity and 1000 ppm sodium benzoate. Pectin, sodium alginate, carboxymethyl-cellulose, sodium hexametaphosphate, gum accacia, esters of alginic acid, variation in TSS, partial replacement of sucrose by dextrose, and smaller particle size of pulp was used to try and prevent pulp separation. Results showed that cloud stability better with pulp of 500-1000  $\mu\text{m}$  particle size. Addition of low viscosity propylene glycol ester of alginic acid gave uniform suspension of pulp in pasteurized juices at levels of 0.4% for 40% TSS and 0.1% at 60% TSS. PEG

8 L 656

#### Glucose syrups in foods.

Palmer, T. J.

Food Manufacture 1971 (March Ingredient Survey) 16-17 (1971) [En] [Tunnel Refineries Ltd., Thames Bank House, Tunnel ave., London, SE10, UK]

After outlining the properties of glucose syrups, applications for bakery products, sugar confectionery, jams and jellies, canned foods, dietetic and infant foods and ice cream are briefly discussed. Glucose syrups are used as sweeteners, flavour enhancers, bodying agents, humectants and texturing agents. JA

8 M 926

[Method for preparing a base ingredient for a bakery product based on rye flour, and method for preparing this product.]

NV Stijfsel en Glucosefabriek "Sas van Gent"; Euro Bakery Centre

Netherlands Patent Application 6 901 780 (1970) [Nl]

A starch product, which has been pre-stiffened in the presence of a sweetening agent, is combined with the usual dough ingredients to considerably shorten the proving time of rye flour products, e.g. breakfast cakes, gingerbread, etc. The starch product may be rye or wheat flour, corn or potato starch, or amylopectin-rich starch. Suitable corn starch is produced by dry-milling degerminated maize. The sweetening component may be sucrose, invert sugar, honey, 2nd or 3rd crystallisate or mother liquor from cane or beet sugar production, glucose syrup with a dextrose equivalent (DE) of 20-70, enzymic starch hydrolysate with a  $\text{DE} \leq 20$ , dextrose, crystallized starch hydrolysate with a DE of 70-98 or mother liquor from glucose production. An instant cake powder is produced by drying an aqueous mixture (e.g. 40 parts rye flour, 50 parts enzymic glucose syrup, 100 parts water) in a thin layer on a heated roller. The baking product may be manufactured without modification to organoleptic properties. W&C

8 S 945

[Development of microflora of sausage meat depending on preservatives used and method of storage.]

Fournaud, J.; Jacquet, B.; Poujardieu, B.

Industries Alimentaires et Agricoles 88 (1) 15-26 (1971) [7 ref. Fr, de, en] [Sta. Centrale de Recherches Laitieres et de Tech. des Produits Animaux, Inra, Jouy-en-Josas 78, France]

Preservative agents used in France for pork sausage meat comprise mixture of cooking salt and "red salts (sels rougisateurs)", the latter comprising mixtures of  $\text{NaCl}$ ,  $\text{KNO}_3$ , glucose, saccharose, lactose (total sugars 10-80%) and usually a red colouring agent. (Use of sulphite is illegal in France). Comparisons were made of the effectiveness of cooking salt and 8 brands of red salts in restraining multiplication of the total aerobic flora and of enterobacteria. The use of nitrite, sulphite and ascorbic acid as secondary additions to a main agent was also studied, together with the results of storage in air at 3°C for 48 h, in shrink film and under vacuum at 3°C and 5°C for 7 and 14 days. Cooking salt permitted the highest bacterial multiplication, nitrite the



lowest; only one commercial red salt was as effective as nitrite. Ascorbic acid did not influence the effect of any main additive, but sulphite had the strongest anti-microbial effect irrespective of the main additive. Storage for 7 days at 3°C in plastics shrink film gave the best results. Highest counts were recorded after 14 days under vacuum. Statistical summaries are given. ELC

9 J 1126]

**Evaluation of monosaccharides, disaccharides and corn syrups as dispersants for heat-processed dried soy milk proteins.**

Sugimoto, H.; Buren, J. P. van

*Journal of Food Science* 36 (2) 346-48 (1971) [11 ref. En] [Agric. Expt. Sta., Cornell Univ., Geneva, New York 14456, USA]

Addition of carbohydrates such as dextrose, sucrose or corn syrups to heat-treated soy milk before drying significantly improved the redispersibilities of the resultant dried products, reaching ~100% at 1.0-1.5 times as much sugar as soy milk solids. Among carbohydrates tested, corn syrups, especially those enzyme-converted in the region of 48.5 dextrose equivalent, seemed to be suitable materials because of their high dispersant efficiency, moderate sweetness and easier drying. One possible reason for the dispersant effects of sugar is suggested to be a physical separation of soy protein molecules. Effects of corn syrups upon the spray-drying of soy milk are also discussed. AS

9 J 1139

**[Method for preservation of perishable products.]**

Bouser, R. P. M.; Blättermann, I. B. B.

French Patent 1 585 399 (1970) [Fr]

Sugared products, e.g. syrups, marmalades and pastes, are manufactured cold by stabilizing fruit or vegetable puree or juice. The moisture content of the base product is brought to 50-60% for dry fruits or 85-90% for juicy fruit, and the action of oxidizing diastases is inhibited, e.g. by acids or SO<sub>2</sub>. Flavouring, colouring and vitamins may be added. The product is then mixed with monosaccharides, preferably dextrose monohydrate, to give a final dextrose content of preferably 27%. The sugar may be blended with citric or tartaric acid, with sorbic acid to inhibit surface moulds, with maltose and dextrin to improve taste, or with protein-rich products, e.g. milk. W&Co

9 P 1549

**[A new problem-free buttermilk drink.]**

Hansen, R.

*Nordisk Mejeri-Tidsskrift* 36 (12) 269-70 (1970)

[Da]

The author discusses the prospects of marketing a pasteurized milk drink, on the lines of that developed in the Schleswig butter factory, W. Germany, based on buttermilk supplemented by lemon syrup, glucose and thickening agent. Preliminary experiments suggest a storage life of ≥14 days for such a product if kept in a refrigerator. GTP

T 481

**Studies on the flavour retention of processed mustard products.]**

Miyoshi, H.

*Journal of Food Science and Technology* [Nihon Shokuhin Kogyo Gakkai-shi] 16 (10) 441-45 (1969) [6 ref. Ja, en] [Kagawa-ken Fermentation & Foods Expt. Sta. Takamatsu, Kagawa, Japan]

The optimum pH of myrosinase activity in mustard was 5.0-6.0 at 50-60°C. The flavour retention of mustard paste was affected by pH and the amount of NaCl added. Mustard paste at pH 3.3-3.8 and pH 3.6-4.0 should contain 4.5% and 13.7% NaCl respectively. Flavour retention increased on addition of sorbitol, starch syrup, and edible oil to the paste, but decreased on addition of amino acid. Flavour was retained most effectively in seed-type mustard when whole seeds were soaked twice in hot water, treated at 65°C for 4 h and then dried completely at 70°C. Addition of glucose to the hot soaking water, improved flavour retention when whole seeds were reduced to powder. HE

9 T 485

**[Artificial sweeteners.]**

Tokyo Shokuzai Kogyo Co. Ltd.

Japanese Patent 6829/71 (1971) [Ja]

Sweetened compositions comprise mixtures of natural sugars such as glucose, lactose, or sucrose with calcium cyclamate, insoluble saccharin, sodium cyclamate, and sodium saccharinate. IFT

9 U 707

**Flavored milk (chocolate) and flavored dairy drink (chocolate).**

United States of America, General Services Administration

Federal Specification C-F-1392A 8pp. (1970) [En]  
Price 10 cents

This Federal Specification, which supersedes Interim Federal Specification C-F-001392 (AGR-C&MS) of 8 Sept. 1967 and Federal Specification C-C-310 of 25 June 1964, covers the requirements for pasteurized chocolate milk and chocolate flavoured drinks for use by Federal agencies, as follows: types and classes of product covered; documents forming part of the specification; material (milk, cocoa and chocolate liquor, sugar, corn syrup, dextrose, invert sugar, salt, stabilizers, additional flavouring); preparation (pasteurization, homogenization, vitamins A and D); finished product requirements; age of product; delivery temp; plant, equipment and workmanship; Federal Food, Drug and Cosmetic Act; quality assurance provisions (sampling, inspection of plants, product ingredients, containers and equipment, and test methods); preparation for delivery (packaging, packing, labelling and marking); ordering data; contractor's inspection; and destination inspection. JA

10 H 1574

**[Use of starch-containing raw materials in the brewery.]** Die Verwendung von stärkehaltigen Rohstoffen in der Brauerei. [A lecture] Wieg, A. J.

*Mitteilungen der Versuchsstation für das Gärungsgewerbe in Wien* 24 (11) 171-178 (1970) [18 ref. De]

The following topics are discussed in general



terms; brewing technology based on conventional malt; sugar, amino acid and protein composition of wort and their influence on fermentation and on the characteristics of the beer; technology of maize, rice, wheat and barley processing; use of starch-containing, unmalted cereals (up to 80% of the malt), without and with the use of enzymes (Brew-N-Zyme); technology of starch, starch syrup, dextrose, and barley and maize syrup production and their use in the preparation of wort; production of soluble wort powder using Brew-N-Zyme; physical and chemical properties of the products discussed; their advantages and disadvantages; flow sheet for continual production of beer using cereal-syrups, instant wort powder and isomerized hop extracts. JMS

OL 810

[Soft sugar coating for sweets.]

Scheuer, M. Martin, J. L.

Revue des Fabricants de Confiserie, Chocolaterie, Confiturerie, Biscuiterie 46 (3) 31-32, 34 & 36-37 (1971) [Fr]

Soft coatings result from the evaporation of a sucrose and glucose syrup mixture onto prepared interiors. The syrups, made up from 1 kgo of sucrose dissolved in 600 cm<sup>3</sup> H<sub>2</sub>O and 1.3 kg of glucose in 300 cm<sup>3</sup> of H<sub>2</sub>O, are combined in various permutations to give different coating consistencies. A more translucent, softer, coating is made using a diluted glucose syrup and the greater the proportion of sucrose syrup the harder and more opaque the coating. 3 syrup coats are given to interiors using a turbine and evaporation is by using cold air. Acceleration of this drying process is aided by using a jet of very fine powdered sugar after each syrup layer. A fourth layer of icing sugar gives a smooth final layer which can then be polished. The completed sweets are air dried for 12-24 h. The manufacture of jelly-babies is described. For covering 100 kg of interiors, 10 kg of syrup and 40 kg of fine sugar are required. SAH

10 P 1732

Milk products.

Cox, M. S.; Frew, A. I. (Pfizer Ltd.)

British Patent 1 232 057 (1971) [En]

A dried product, consisting for instance of 60% dried skim-milk, 25% glucose, 10% cocoa and 5% vitamins, minerals etc., is agglomerated by steam injection whilst being maintained in suspension in the form of fluidized bed. Saturated steam is preferably used. The aim is to improve the reconstituting capacity of the product in water, milk or other similar liquids. FL

QT 543

[Study of changes during thermal and hydrothermal processing. XVI. Paper chromatographic detection of cyclohexylamine formation during decomposition of sodium cyclamate under various heating conditions.] Studium der Veränderungen bei thermischen und hydrothermischen Vorgängen. XVI. Papierchromatographischer Nachweis des bei der thermischen Zersetzung des Natrium-Cyclamats entstehenden Cyclohexylamins.

Hrdlicka, J.; Janicek, G.

Zeitschrift für Lebensmitteluntersuchung und -Forschung 145 (5) 291-293 (1971) [11 ref. De, en] (Lehrstuhl für Lebensmittelchemie, Chem.-tech.

Hochschule, Prague, Czechoslovakia]

Sodium cyclamate was found to decompose on heating at 130°C for 90 min with the formation of cyclohexylamine. The amount formed increased with rising temp., decomposition being complete at 190°C after 60 min. The presence of 1% glucose or glycine accelerated the reaction, and increased the amount of cyclohexylamine found. HSi.

11 D 712

[Production statistics for the French chocolate and confectionery industries in 1970.]

Anon.

Chocolaterie Confiserie de France 1971 (271) 5-9 (1971) [Fr]

1970 production statistics for the French chocolate and confectionery industries (with 1969 data in parentheses) included the following utilization figures (tons): total raw materials, 394 090 (380 460); cocoa beans, 39 530 (43 085); cocoa butter, 14 215 (14 520); sugar, 197 625 (196 095); and glucose, 66 680 (61 470). A total of 344 425 tons (341 525 tons) of finished products were produced, valued at NF 2 310 220 (NF 2 186 035). Some data are included on utilization of chemicals, packaging materials and fuel. FdeAR

11 L 933

[Process for producing candied fruit, particularly candied strawberries.] Verfahren zur Herstellung von Dickzucker-Früchten, insbesondere Dickzucker-erdbeeren.

Jung, H.; Oswald, G. (Opekta-GmbH & Co.)

West German Patent Application 1 928 731 (1970) [De]

Firm, fully ripe strawberries are freeze-dried to a moisture content of ≤5% (preferably 0.5-3.5) wt. %. They are then saturated with a sugar solution containing 70-80% by wt. DM at ≤45° (preferably 40°) C. The solution consists of ≥30% by wt. invert sugar and sorbitol and/or dextrose and/or sucrose etc. Treatment is terminated when the fruit reaches a constant wt. After draining, they are coated with a gel or gum arabic. The product has a good aroma and a natural colour and does not shrink during processing. W&Co

11 L 983

Preparation and processing of a frappe.

Mansvelt, J. W.

Naarden Nieuws 22 (225) 2-4 (1971) [En]

The composition, function, preparation and processing of frappe in manufacture of confectionery and details of apparatus and recipes for its preparation are described. Recipes for standard frappe preparation by planetary whipping machine (2 stage process) or high-pressure whipping machine (single stage process) show that the latter is more economical. Directions for making glucose frappe are included. The influence of the dextrose equivalent (DE) of glucose and the whipping temp. on sp. gr. and foam stability of frappe, and of the quantity of frappe incorporated on sp. gr. of the final product are discussed: higher DE and temp. reduce sp. gr. and foam stability of frappe, increasing amounts of frappe reduce sp. gr. of product. A dosage of 15-25% frappe, rapidly incorporated at low mixer speed, is recommended, especially for masses with a high % of fat or low % of water. RM



11 L 984

**"A fresh candle casts new light."**

Kuzio, W.

**Confectionery Production 37 (6) 333-335 & 356 (1971) [En]**

Papers given at the Pennsylvania Manufacturing Confectioners' Association "Silver" production conference ranged from oxidative changes in butter creams to starches and glucose syrups with controlled functions. BFMIRA

11 L 986

**Confectionery ingredients-composition and properties. XI. Glucose syrups and maltodextrins.** Cakebread, S. H.

**Confectionery Production 37 (6) 339-344. (1971) [En]**

The paper deals with the manufacture and types of maltodextrins and glucose syrups, their optical properties and sweetness. The discussion includes a graph showing the relationship between the degree of conversion and specific rotatory power, and tables of the proportions of carbohydrates in maltodextrins and glucose syrups. BFMIRA

11 L 990

**Confectionery syrup.**

Walon, R. (Corn Products Co.)

**Canadian Patent 868 304 (1971) [En]**

Confectionery syrups have a dextrose equivalent of <60 and contain (in terms of total carbohydrate solids) 3-16% levulose, 10-35% dextrose, 10-25% maltose, and 15-40% oligosaccharides. IFT

11 P 1886

**[Glucose syrup and dextrose for ice cream.]**

Glukosesirup und Dextrose für Speiseeis. [A lecture]

Thieme, E.

**Fette, Seifen, Anstrichmittel 73 (4) 255-257 (1971) [De, en, fr, ru]**

11 T 570

**[Process for producing a natural aroma concentrate.]** Verfahren zur Herstellung eines natürlichen Aromakonzentrates.

Scheide, J. (Haarmann &amp; Reimer GmbH)

**West German Patent Application 1 767 826 (1971) [De]**

Edible, water-soluble proteins and/or amino acids are heated to 120-145°C at 4-6 atm. in the presence of mono- and/or di- and/or triglycerides of natural fatty acids, and/or edible carbohydrates, e.g. pentoses and hexoses. Suitable proteins are aqueous extracts or the autolytic, hydrolytic or enzymic decomposition products of animal or vegetable substances, e.g. meat extract, peptones, peptoses and yeasts, e.g. *Saccharomyces* and *Endomyces*. Suitable glycerides are natural triglyceride mixture of saturated or unsaturated carbonic acids with a C<sub>4</sub>-C<sub>22</sub> chain, and suitable carbohydrates include mono-saccharides, ribose, glucose, mannose and ructose. The resulting product imparts a roast flavour to canned meat so that the frying step can be eliminated during meat processing. W&Co

2 K 154

**The prevention of crystallization of glucose incorporated in chocolate.**

Takanishi, Y.; Shiomi, S.

**International Chocolate Review 26 (2) 50-59**

(1971) [3 ref. En] [Govt. Ind. Res. Inst., Osaka, Japan]

The use of sucrose esters for prevention of glucose crystallization in chocolate was investigated. While no change occurred in chocolate stored at room RH, crystallization occurred during 4 days storage under humid conditions (RH >75%), with very large crystal in glucose-containing chocolate. Adding 1% sucrose esters prevented glucose crystallization and lowered viscosity by improving dispersion of solid particles. Treatment of powdered glucose with sucrose esters in alcoholic solution or by a hot-mixing method at temp. >60° and <100°C with 0.2-1.0% sucrose ester powder (CH) or 0.4-1.0% paste (CHS) prevented crystallization during 4 days but not 7 days of storage at RH 75%. As viscosity of chocolate increased with larger quantities ≥1% of sucrose esters, 0.6% was the optimum quantity. Adsorption of cocoa butter onto β-glucose was reduced from 68.8% to 34.6% by treatment with 0.6% CH, 35.8% with 1% CHS and 45.2% with 0.5% CH (alcoholic solution). The hot-mixing process was considered to be the most effective method on account of its simplicity and economy. RM

12 L 1041

**Starch gums: transparent starch gums and jellies.**

Slawatycki, A.

**Confectionery Production 36 (12) 741-744 & 774 (1970) [En]**

A list of raw materials required to cover the whole range of possible consistencies of starch-based gum and jelly sweets is given. The following recipes are also included: jelly sweets of 1-5 g wt.; gum sweets; foamed gum; pure sugar (invert sugar) sweets; and pure glucose sweets. BFMIRA

12 L 1085

**Hydrocolloids as icing stabilizers.**

Svolos, T.

**Bakers' Digest 45 (3) 57-61 (1971) [4 ref. En]**

Basic Foods Inc., Englewood, New Jersey, USA]

Hydrocolloids are grouped into gums derived from tree exudates, seaweed colloids, seed extracts, water-dispersible cellulose derivatives and gelatin. The mechanism of gel formation is explained. Brief description of the most commonly used edible hydrocolloids; alginates, tragacanth, gum arabic, carrageenans, locust bean gum, guar gum, agar, cellulose gums, pectin substances, and gelatin are given. Hydrocolloids function by stabilizing the size of the sugar crystals, imparting body to the mass, aiding in the uniform aeration of the system, and by controlling the drying rate of the icing. Dextrose, corn syrups, invert syrups, lactose and fondants are also used in icings. Stabilizers are available in plastic or powder forms and are either of the boiling or non-boiling type. PEG

12 L 1129

**Sugar confectionery.**

Anon.

**British Food Journal 73 (843) 107-109 (1971) [En]**

Sugar consumption in 1967 was 17.21 oz/person/wk and 2.88 oz honey and sugar preserves.

Consumption by old-age pensioners was 19.92 oz and 4.32 oz respectively. While consumption of sugar



itself has fallen, consumption of sugar in manufactured foods has risen. Use of sucrose substitutes (e.g. corn syrup, mixtures of sugars, dextrose, fructose, sorbitol) in sweets and icings; fats (cocoa butter, hydrogenated vegetable fats, vegetable oils, lecithin) in creams, hard butters and cocoa butter-like products; eggs in cakes and egg custard; gels (gelatin, carrageenan, vegetable extractives) and chemical additives to improve them; artificial colours and flavours, and miscellaneous additives are discussed in general terms. PEG

12 P 2106

**Storage stability of CSM: alternate formulations for corn-soy-milk.**

Bookwalter, G. N.; Moser, H. A.; Kwolek, W. F. Pfeifer, V. F.; Griffin, E. L., Jr.

**Journal of Food Science** 36 (5) 732-736 (1971) [11 ref. En] [USDA N. Util. Res. and Development Div., N. Regional Res. Lab., Peoria, Illinois 61604, USA]

Corn-soy-milk (CSM), a high-protein food supplement for children, contains pregelatinized corn meal, soya flour, nonfat dried milk, vitamins and minerals. To increase the choice of possible ingredients, several formulations were studied. Flavour and chemical test after storage at 77, 100, and 120°F were made on experimental samples containing corn meals and soya flour, dried whey increased levels of nonfat dried milk, sucrose and dextrose hydrate. Stability was adequate for all formulations tested except those containing dextrose hydrate or unprocessed whole corn meal. At storage temp. of 100°F or above, substantial losses in available lysine occurred in the samples containing dextrose hydrate. [See also following abstr.] AS

12 P 2212

**[Development of milk ice containing ~80% more protein and 20% fewer calories than ordinary Norwegian ice cream.]**

Steinsholt, K.

**Meieriposten** 60 (20) 431-444 (1971) [12 ref. No, en]

The author describes a milk-based ice cream containing 80% more protein and 20% fewer calories than ice cream usually sold in Norway. This was achieved by adding 4% sodium caseinate, prepared from spray-dried skim-milk, to the formula and by raising the total solids of the products by substituting the less sweet glucose for sucrose. A cocoa-flavoured product was preferred to one flavoured with vanilla. DJS











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See also back page

18  
 development and consumer evaluation of soft-serve frozen desserts.

ewenstein, M.; Dell, W. J.  
**Food Product Development** 5 (2) 32, 34 & 36 (1971) [5 ref. En] [Univ., Athens, Georgia, USA]  
 A standard soft serve frozen dessert containing 4% fat, 10% milk SNF, 17% sweetener and 0.5% stabilizer/emulsifier was modified and test samples subjected to consumer preference tests. The altered mixes contained 4% milk fat; 1% milk fat + 3% vegetable fat; or 4% vegetable fat. The vegetable fat, chosen after 20 sources had been evaluated was a highly refined coconut oil. In addition, the final formulation contained a 60:40 blend of sucrose-dextrose syrups as this was found to give a better flavoured product than the usual sucrose-glucose syrup blend. Melt down tests showed that the mixes had nearly equal resistance. The consumer preference tests showed that there was no preponderance of preference for any one sample, with the all vegetable fat and the all milk fat samples receiving exactly the same ratings. The authors concluded that the use of a vegetable fat which was more highly saturated than milk fat may be questioned nutritionally. JR

30  
 physical properties of confectionery ingredients. Kiebreid, S. H.

**Confectionery Production** 37 (8) 461-464 & 470 (1971) [En]  
 A detailed examination of the effects of invert sugar, glucose syrup or mixtures of both on the solubility of sucrose in grained confections is presented. To illustrate the various themes of the discussion, graphs are given showing the relationship between the ratio of sucrose to other sugars and the amount of liquid phase: solid phase, and the % of dissolved solids in grained confections. The consistency, texture and crystallization of such confectionery items is considered and a table of % solid and liquid phases, and dissolved solids in the liquid phase, in mixes containing differing sucrose: sucrose ratios is given. BFMRIA

63  
 wing gum composition. Zicki, M. M.; Kimball, B. A. (Corn Products)

**United States Patent** 3 589 909 (1971) [En]  
 Dextrose in combination with a starch hydrolysate having a dextrose equivalent of ~5-25 replaces sucrose in a gum confection so as to reduce drying time and improve resiliency, strength, firmness, gloss and skin formation. IFT

1  
 physical properties of confectionery ingredients. Kiebreid, S. H.  
**Confectionery Production** 37 (9) 535-538 (1971)

The influence of the humectants glycerol and sorbitol, and solutions containing >2 dissolved

components are discussed and illustrated graphically. The effects of alcohol on the solubility of sucrose are similarly treated. The effects of sucrose on the solubility of other sugars, such as dextrose, are also considered with reference to tabulated data. BFMIRA

1 M 69

**Browning of chapaties.**

Abrol, Y. P.; Upreti, D. C.; Ram, A.;  
**Journal of Food Science and Technology (Mysore)** 8 (1) 26-27 (1971) [12 ref. En] [Cereal Quality Lab., Div. of Genetics, Indian Agric. Res. Inst., New Delhi-12, India]

In one series of experiments, chapaties were prepared from whole wheat flour (atta) obtained from Indian tall wheat species (a) with no additives, (b) with addition of various amounts of sucrose and glucose and (c) with addition of sucrose, glucose and amino acids. No browning occurred in any case, indicating the absence of caramelization or Maillard reaction in the browning process. In a second series of experiments, chapaties were prepared from Mexican dwarf wheat (high in tyrosinase activity) and Indian tall wheat (low in tyrosinase activity). Chapaties prepared from the former showed browning (accentuated by addition of catechol, but absent after addition of tyrosinase inhibitor even in the presence of added catechol) whereas chapaties prepared from Indian tall wheat showed no browning (even in the presence of added catechol). It was concluded that tyrosinase is an important prerequisite for browning of chapaties. BM

1 P 58

**Thermal diffusivity of ice cream at cryogenic temperatures.**

Ross, I. J.; Rudnick, Jr., A. W.; Fox, J. D.  
**Transactions. American Society of Agricultural Engineers** 14 (1) 52-54 & 59 (1971) [5 ref. En] [Agric. Eng. Dept., Univ., Lexington, Kentucky, USA]

The thermal diffusivity ( $\alpha$ ) of ice cream in the temp. range -20° to -320°F was estimated with a view to the design of production systems using liquid N<sub>2</sub> for hardening and cooling. The basic mix contained 11.1% milk fat, 15% sugars, 0.15% stabilizer and 38.75% TS. The effect of relative proportions of various sugars was tested with (i) all cane sugar, (ii) 75% cane, 25% corn sugar (dextrose) and (iii) 50% cane, 50% corn sugar. Results are shown graphically and in a table. Estimates of  $\alpha$  ranged from 0.015 ft<sup>2</sup>/hr at -20°F to 0.054 at -320°F.  $\alpha$  decreased with increased corn sugar %, but varied by <2.5% of average for all concn. tested. The difference was considered negligible. Certain inconsistencies in  $\alpha$  determination by the technique used, due to variation of  $\alpha$  with temp. and position within the sample tested are discussed. RM

2 G 91

**[Food supplement for pregnant women.]**

Societe Aponti-France

**French Patent** 2 053 703 (1971) [Fr]



Ca, vitamins and higher proteins are provided by a single food supplement of neutral flavour. 15 g sesame seeds and 17 g sucrose are ground together, and 0.05 g halibut liver oil dispersed through 15 g glucose is admixed, together with 28 g dried skim-milk, 5 g wheat-germ, 5 g lactic yeast, 5 g dried whole egg, and 1 g freeze-dried liver. This mixture is moistened with a syrup made from 3 g glucose in 10 ml water, and screened to a grain size of 1-2 mm. The granules are spread in a thin layer and caramelized by heating at 140°C for 20 min. To the powdered granules are added 2.35 g tricalcium phosphate, 2 g starch and 1.6 g aromatic substances, and the product is compressed into 7 g tablets. Daily dose is 25-50 g. W&Co

2 H 282

[Process for colouring sugars or sugar mixes.]  
Verfahren zum Anfärben von Zuckern oder Zuckermischungen.

Exverbet Import & Export GmbH

West German Patent Application 2 001 741 (1971)

[De]

Sucrose, glucose, lactose, or mixtures of these, are mixed with 10% maltodextrin and 5-10% edible colouring, e.g. caramel for a coffee colour and beetroot powder for a redcurrant colour. After the mixture has been sprayed with 10% water, it is dried at 12 mm Hg and  $\geq 60^\circ\text{C}$ , preferably  $90^\circ\text{C}$ , and comminuted to the required particle size. The product is used in instant beverage powders. W&Co

2 H 330

United States Patent 3 598 609 (1971) [En]  
equivalent) starch hydrolysate syrup. IFT  
Hoynak, P. X.

Unit portion packages of acidic liquid concentrates contain as sweetening agent 30-70% by wt. sucrose dissolved in a 25 DE (dextrose

2 L 143

Sweet syrups.

Walon, R. (Corn Products Co.)

Canadian Patent 877 950 (1971) [En]

Sweet syrup is produced by the interconversion of dextrose. Deanionization of a starch conversion syrup by electrodialysis or ion exchange, prior to isomerization, permits production of sweet syrups having improved properties. IFT

2 L 144

Syrup production.

Corn Products Co.

British Patent 1 239 776 (1971) [En]

A dextrose solution is subjected to electrodialysis to reduce its anion concn. prior to interconversion to ketose in the preparation of sweet syrups containing  $\sim 12\%$  laevulose. IFT

2 L 154

Marshmallow: technology and methods of manufacture  
Minifie, B. W.

Manufacturing Confectioner 51 (4) 31-37 (1971) [14  
ref. En] [Div. of Knetchel Res. Sci., Inc.,  
Saltford, Bristol, UK]

Manufacture of various types of marshmallow is described, with reference to recipes, types of mixing and beating equipment, and properties of ingredients (corn syrups, dextrose, invert sugar, egg albumen, agar, gum arabic, gelatin, and modified milk and soy proteins). Factors reducing shelf-life are discussed; these include deterioration due to high moisture content, poor drying conditions, microbial degradation of whipping agents, oxidation of ingredients, crystallization of sugar, loss of aeration, and the anti-foam action of fats, oils and essential oils. Recommendations include efficient plant hygiene, sterilization of equipment and pasteurization of ingredients susceptible to microbial contamination. ATDW

2 L 156

Fondant compositions.

Nestle's Products Ltd.

British Patent 1 236 895 (1971) [En]

Fondants are prepared by cooling a hot aqueous solution containing both dextrose and a non-dextrose sugar and allowing the solution to crystallize. IFT

2 L 173

[Almond paste substitute.]

Societe d'Etudes et Fabrications Alimentaires  
SEFASA

French Patent 2 049 589 (1971) [Fr]

Onto 25 parts by wt. of icing sugar, beaten with 10 parts water and 1 part aerating agent to a firm consistency, is poured a mixture of 100 parts granulated sugar, 90 parts glucose and 25 parts water; this is heated to 130-135 °C. under gentle agitation. Then 10 parts powdered corn starch, 15 parts icing sugar and 17 parts hydrogenated palm oil are added together with flavouring and colouring, and the product is homogenized by beating. W&Co

2 L 196

[Manufacture of marrons glaces from freeze-dried chestnuts.]

Andreotti, R. Aglio, G. dall; Tomasicchio, M.  
Industria Conserve 46 (2) 101-102 (1971) [It, fr,  
en, de] [Sta. Sperimentale per Ind. delle  
Conserve Alimentari, Parma, Italy]

Marrons glaces were prepared from chestnuts which had been washed, longitudinally incised, autoclaved at 100 °C for 15 min, cooked for 60-150 min in boiling water, cooled, frozen to -20 to -25 °C and freeze-dried in a Biss BV 8/S plant. They were then placed in various warm sugar syrups of 70 °Brix prepared from glucose or sucrose at various concn. Marrons glaces prepared by this process were compared with those prepared from fresh chestnuts. Freeze-dried products had a

er colour, were more rapidly impregnated by sugar solutions and showed a wt. gain of 37% compared with the fresh products after the drying process; before, they showed a wt. gain of 61% compared with the fresh chestnuts. The results were obtained when the chestnuts were immersed in the sugar syrup at 70°C for 1 h at a pressure of 360 mm Hg and then for 5 h at atm. pressure. Process is quicker and simpler than the traditional process and allows the chestnuts to be freeze-dried at certain times of the year and then taken in store to be candied and marketed all the year round. LA

219

#### Automatic production of fructose.

Barry Azucar 66 (9) 22, 24, 50 & 53 (1971) [10 ref. En & Es]  
90% of the 2 million tons of sugar consumed annually in Japan is imported, so glucose, with a sweetness 60-70% that of sucrose, is often used as a substitute. A method has now been developed for producing glucose isomerase from *Streptomyces* in a medium containing xylan or xylan-degrading materials (wheat bran, corn cob, corn cobs, etc.). The isomerase is purified by acetone precipitation, DEAE cellulose and sephadex column chromatography and used to convert glucose into fructose. A typical flow diagram of the process is given. PG

25

#### Composition of reducing sugars in an alkaline medium.

Barry M.  
*Industries Alimentaires et Agricoles* 88 (7/8) 981-984 (1971) [7 ref. Fr. de, en]  
Practical effects of interconversions between glucose, fructose and mannose, and the conversion of hexose sugars to acids when heated in an alkaline medium are discussed. In the conversion of glucose to fructose, the rate of degradation of fructose is faster than that of glucose, but interconversion of fructose to glucose is faster than the reverse, so glucose accumulates to reach a glucose:fructose value of 2.5. Decomposition of hexoses by heat to produce various acids results in lower pH, lower reducing power and increased brown colour. These acids form soluble salts with certain ions, some free acids are insoluble, others are precipitated by lime. Particular attention is given to the fact that as alkalinity increases, the composition of invert sugar leads to the action of glucose plus fructose, followed by degradation of glucose, the reducing power of the solution changes from negative to slightly positive, which may introduce errors in analytical work. ELC

32

#### Freezing and storing of kefir grains in the presence of protective substances.

Seev, N. G.; Dmitrichenko, M. I.; Dmitrichenko, M. S.

*Molochnaya Promyshlennost*, 32 (9) 14-16 (1971) [5 ref. Ru] [Leningradskii Tekh. Inst. Kholodil'noi Promyshlennosti, Leningrad, USSR]

Experiments, based on those of Toma & Melegi [Moloch. Prom. (1960) 21 (4) 13-15], were carried out to establish optimal conditions for preservation of kefir grains by freezing. Slow freezing to -10°C using sterile skim-milk with 5% glucose or a 20% glycerol solution as protective substances and subsequent rapid defrosting by immersion in water at ≤40°C for 2-3 min enabled frozen kefir grains to remain active for ≤1 month,

and to regain full original activity within 5-7 days after defrosting. Frozen storage for >1 month resulted in the death of the yeast component. SKK

4 H 586

#### A study of some of the factors affecting the spray drying of concentrated orange juice, on a laboratory scale.

Brennan, J. G.; Herrera, J.; Jowitt, R.  
*Journal of Food Technology* 6 (3) 295-307 (1971) [18 ref. En] [Nat. Coll. of Food Tech., Weybridge, Surrey, UK]

The unsatisfactory results of spray drying trials on conc. orange juice showed the need for an added drying agent. Sodium carboxymethylcellulose was tried in this context, but proved ineffective, and although gum acacia was partially effective, heavy wall deposition still occurred. BPC liquid glucose (39-43 dextrose equivalent) reduced wall deposition, and a product of acceptable flavour and good free-flowing properties resulted. Variations in air inlet temp., feed temp. and rate and atomizer speed produced no significant changes in the product. The problems of wall deposition were found to be minimized when the wall cooled to below the 'sticky point' of the product. BFMIRA

4 L 333

#### [Influence of glucose syrup and other moisture retaining substances on the preservation of confectionery products.]

Gerin, M. M.  
*Revue des Fabricants de Confectionnerie, Chocolaterie, Confiturerie, Biscuiterie* 46 (10) 24, 27, 29 & 31 (1971) [2 ref. Fr] [Société des Produits de Mais, 379, Avenue de la Libération, 92 Clamart, Hauts-de-Seine, France]

The relative humidity equilibrium (RHE) of confectionery products is an important factor in their keeping quality. The article describes how the RHE of a product may be calculated from its content of water, glucose syrup, sucrose, fructose, gelatin, gum arabic or starch. Slight modifications in the formulation of the product can increase or decrease the RHE as required. 3 examples of the calculation for products containing either gum arabic, starch or gelatin are given. MFC



4 L 362

**Fruit jellies.**

New Time Foods Ltd.

**British Patent** 1 250 782 (1971) [En]

Mixtures of fruit juice, sucrose and glucose syrup are boiled until a solids content of  $\geq 65\%$  is achieved, after which the mixtures are cooled to form a clear jelly to which is added pre-formed pectin jelly shapes of a contrasting colour. IFT

4 P 581

**Dessert compositions.**

Mitchell, J. H.; Stringer, P. (Rowntree Mackintosh Ltd.)

**British Patent** 1 255 391 (1971) [En]

A powdered dessert base composition contains 31.6% sugar, 28.2% dried skim-milk, 24.5% glucose syrup solids, 6.8% sodium caseinate and 6.2% gelatin + sodium carboxymethyl cellulose, flavouring and colouring, and sodium hexametaphosphate. A dessert of mousse-like texture is prepared by whisking for 2 min a mixture of 90 g of the composition and 180 ml water and allowing it to set at refrigerator temp. for 10-20 min. FL

4 P 600

**Curd from Miltone (vegetable toned milk).**

Krishnaswamy, M. A.; Patel, J. D.; Dhanaraj, S.; Govindarajan, V. S.

**Journal of Food Science and Technology (Mysore)** 8 (2) 41-46 (1971) [17 ref. En] [Central Food Tech. Res. Inst., Mysore, India]

Miltone, consisting of groundnut protein isolate, liquid glucose, minerals and vitamins, was used as a substitute for dried skim-milk in the manufacture of toned milk which was subsequently used to produce a curd or dahi, a popular fermented milk product, as follows: 500 ml milk was heated at 85°C for 30 min, cooled to room temp., inoculated with 1.5% (v/v) single-strain or mixed cultures and incubated for 14-16 h. Carbonation of the curd with CO<sub>2</sub> for 3 min prior to filling in  $\frac{1}{2}$  l. milk bottles afforded it a satisfactory shelf-life, the curd retaining its structure and flavour during storage. Of the starter strains tested, *Streptococcus citrophilus* produced the most acceptable curd ( $P < 0.05$ ). Curd made from cows' milk was judged to be significantly better in terms of colour, appearance, aroma and overall acceptability on organoleptic evaluation using a panel. SAC

5 K 81

**[Grape sugar chocolate: possibilities and problems.]**

Traubenzuckerschokolade: Möglichkeiten und Probleme.

Völker, H. H.

**Süßwaren** 15 (22) 918-920 (1971) [De]

Traditional production of a high grade grape sugar chocolate containing virtually only dextrose

as sweetening agent involves less than max. retention of crystallization water content of the dextrose, the cocoa mass first being conched, and the dextrose then being incorporated at 35-45°C. The resultant mass, after rolling, is liquefied in a melangeur or drum grinder at 38-42°C and then made into slabs without any need for tempering. New developments since 1965 make use of dextrose freed from molecularly bound water of crystallization by drying, which simplifies the process. Water-free dextrose, unlike hydrated dextrose, can be ground without difficulty in standard sugar mills. Flow characteristics, colour, organoleptic quality and storage life were other criteria of quality. IN

5 L 417

**A study of the rate of gain or loss of moisture from sugar and sugar confectionery products during storage.**

Norrish, R. S.

**Research Report, British Food Manufacturing Industries Research Association No. 144:** 25 pp. (1969) [4 ref. En] Price £1.25 [British Food Manufacturing Ind. Res. Assoc., Randalls Road, Leatherhead, Surrey, UK]

Results are presented of a study on the effects of different humectants on the rate of moisture loss or gain from confectionery products under controlled temp. and RH conditions. The humectants studied were glucose syrup, invert sugar, dextrose, laevulose, sorbitol and glycerol. Their effects have been examined in fondant, marshmallow, gelatine jellies and boiled sweets, and also in saturated sugar syrups. The report includes a description of a novel dew-point method for the accurate measurement of RH in confined spaces. BFMIRA

6 J 957

**Consumer responses to canned peaches packed in different syrups.**

Arthur D. Little Inc.; Sugar Research Foundation Inc.

C-68469 vii+87+Al-A9pp.; C-69469-1 vii+85+Al-A9pp.; Summ. Rep. x+8pp. (1967 & 1971) [En] Cambridge, Massachusetts, USA: Arthur D. Little, Inc.

Consumer preferences for canned cling peaches packed in different syrups were investigated on behalf of the Sugar Research Foundation (Project No.224) by Arthur D. Little, Inc.; detailed results are submitted in 2 Reports Nos. C-68469 and C-69469-1. Peach packs were prepared by standard commercial procedures, containing 100% sucrose syrup or 15, 25, 33.33, 42 or 50% replacements by either corn syrup (i) or dextrose (ii). Detailed analytical and flavour profile examinations were made by laboratory staff. Preliminary paired comparison tests were made to detect the ability of untrained observers to detect differences between peaches canned in 100% sucrose and in 15, 25 and

3.33% replacement by (i) or (ii). Comprehensive home use tests were made by 1735 persons (532 families) for (i) and 1585 persons (491 families) for (ii). Final self-comparison tests were made by 2 groups of 75 families receiving 2 identical cans of either 100% sucrose or 25% (i). All observations are subjected to detailed statistical analysis. Consumers could distinguish between 2 peaches of different flavour (not unusual) packed in the same syrup. In general 100% sucrose was preferred, with 42 or 50% replacements considered definitely inferior. Flavour differences from 100% sucrose were readily detected even with only 15% of (i) or (ii). Slight inconsistencies were found with 25% of (i) and 33.33% of (ii), apparently due to the sweet-sour balance. The preference for 100% sucrose was stated to be sweetness and to a lesser extent texture. If (i) or (ii) are used for economic reasons, it is recommended that replacement should not exceed 25% max. ELC

L 450

**Rational use of sugar types, for production of sweets.]** Rationeller Einsatz von Zuckersorten bei der Bonbonherstellung. [A lecture] Schwegel, H.; Kolber, A.

*Gordian* 72 (2) 41-50 (1972) [15 ref. De] Zentrale-Lab. der Süddeutschen Zucker-AG, Oberrhein, German Federal Republic]

Rationalization of manufacture of hard sweets by using special types of sugar, e.g. liquid sugar, glucose syrup, mixed sucrose and glucose syrup, is discussed with reference to product quality and cost reduction. Storage tests on mixed syrups, stability of sugar in sweet masses made with mixed syrups and importance of physico-chemical characteristics, solubility, crystallization, hydrolysis (inversion), viscosity and hygroscopicity are discussed and results from previously published reports are presented graphically and in tables. Mathematical relationships for predicting rate of hydrolysis, viscosity and hygroscopicity (equilibrium moisture) of sugar syrups under specified conditions are given. RM

A 328

**Formation of 2-(5-hydroxymethyl-2-formylpyrrol-1-yl) alkyl acid lactones on roasting alkyl- $\alpha$ -amino acids with D-glucose.**

Shigenaga, H.; Kato, T.; Kato, H.; Tomaki, M. *Agricultural and Biological Chemistry* 35 (12), 2097-2105 (1971) [10 ref. En] (Dept. of Agric. Chem., Fac. of Agric., Univ. of Tokyo, Japan)

The roasting reactions between glucose and several alkyl- $\alpha$ -amino acids (glycine, D- $\alpha$ -alanine, D- $\alpha$ -amino-n-butyric acid, L-valine, L-leucine and D- $\alpha$ -amino-n-caproic acid) were examined and a series of lactones were newly identified as the characteristic flavour compounds. Isolation and identification of the lactones by GLC and UV, IR, MS and NMR spectrometry, and subjective aroma evaluation is described. The following aromas were

ascribed to lactones obtained after roasting glucose with alkyl amino acids at 200°C or 250°C: 2-(5-hydroxymethyl-2-formylpyrrol-1-yl) propionic acid lactone gave caramel with a little scorching; the n-butyric acid lactone gave maple, strong sweet; the isovaleric and isocaproic acid lactones gave miso, soy sauce, slightly chocolate-like aromas. RM

7 L 568

**Kinetics of dextrose degradation under autoclaving conditions.**

Taylor, R. B.; Jappy, B. M.; Neil, J. M.

*Journal of Pharmacy and Pharmacology* 24 (2) 121-129 (1972) [5 ref. En] [School of Pharmacy, Robert Gordon's Inst. of Tech., School Hill, Aberdeen, UK]

The kinetics of decomposition of dextrose over a temp. range of 106-127°C were investigated. The reaction showed an induction period with respect to 5-hydroxymethylfurfural production due to formation of an unidentified intermediate compound. A reaction mechanism consistent with the experimental measurements is proposed. Rate constants for the various reaction steps were calculated and activation energies associated with these steps reported. RM

8 H 1269

**[Change of the activity of  $\beta$ -fructofuranosidase in wine in relation to the concentration of sucrose and its hydrolysates.]**

Oreshkina, A. E.; Novikova, V. N.

*Prikladnaya Biokhimiya i Mikrobiologiya* 5 (4) 455-459 (1969) [8 ref. Ru, en]

Effect of sucrose and its hydrolysates on the activity of  $\beta$ -fructofuranosidase in wine was studied. With increase in sucrose concn. the enzyme activity increased by 6-8%, but then decreased. Glucose and fructose had an inhibitory effect in direct relation to their concn. AS

8 L 586

**[The determination of equilibrium relative humidity and its effect on the shelf life of the product.]** Die Bestimmungen des GE-Wertes und sein Einfluss auf die Haltbarkeit des Produktes.

Thieme, E.

*Gordian* 72 (4) 132-135 (1972) [1 ref. De]

The importance of equilibrium relative humidity (ERH value) on shelf life of confectionery products is discussed. Methods of measuring ERH are described, including that of Landrock & Proctor [Food Tech. (1951) 5: 332-336], the SINA apparatus, and use of sorption isotherms illustrated by isotherms of full milk powder, glucose and a 3:1 mixture of sucrose and glucose syrup. ERH of manufactured products can be raised by addition of glucose syrup of low dextrose equivalent (38 DE, ERH 88.5), or lowered by fructose (ERH 80).



dextrose (ERH 81) or sorbitol (ERH 82). In long term storage trials, no fungal growth occurred on inoculated samples of fondant at ERH <76.5 or marzipan at ERH <77.5. In view of seasonal fluctuations of air RH, corresponding changes in recipes of foamed products are recommended.  
RM

8 L 641

[Powdered cream-like product.] Cremepulver für Speisezwecke.

Kaack, C.; Baum, W.; Heine, C. (Henkel & Cie GmbH)

West German Patent Application 2 022 776 (1971) [De]

Free-flowing powdered cream-like product used for cake fillings and decorations, particularly for instant cake mixes, contains the following ingredients: 70-80% (by wt. of the powdered cream) powdered components, comprising 25-99% (by wt.) powdered milk or egg, 1-5% gelatin, alginate, carob bean kernel flour, tragacanth, pectin, agar-agar, polyacrylic acid, polyvinyl alcohol, methyl cellulose, carboxymethyl cellulose, guar flour, or, preferably, pre-gelatinized starch to improve the whipping qualities of the cream, and  $\leq 70\%$  icing sugar, glucose or vanilla sugar; and 20-30% fat, comprising (by wt. of total fat content) 85-93% edible fat, e.g. groundnut oil with an mp of 30-35°C and dilatation of 800-1500, preferably 1100-1400 at 20°C, and 7-15% of a fat-dissolving emulsifier with hydrophilic lipophilic balance (HLB) value of 5-16, preferably mono- and diglycerides of saturated and unsaturated fats, lactic acid monoglyceride, polyglycerin fatty acid esters, sorbitan fatty acid esters, polyoxyethylene fatty acid esters, diacetyl tartaric acid mono- or di-fatty acid glycerides, lecithin or mixtures of these, particularly 1 part by wt. polyoxyethylene sorbitan stearate and 1.5 parts by wt. sorbitan stearate. W&Co

9 A 390

The influence of turbulent flow on the sensory assessment of viscosity in the mouth.

Parkinson, C.; Sherman, P.

*Journal of Texture Studies* 2 (4) 451-459 (1971) [9 ref. En] [Unilever Res. Lab., Welwyn, Hertfordshire, UK]

Viscosity was measured of samples of liquid foods both in their normal state and after they had been introduced into the mouth and ejected at the stage at which they were considered to be ready for swallowing. Low-viscosity Newtonian liquids (5-48% glucose syrups and 95-100% rose hip syrups) showed turbulence in a cone plate viscometer at high rates of shear, comparable to those believed to be operating in the mouth during sensory assessment of their viscosity. This effect is partially reduced by saliva, with the net result that these liquids appear to have a higher viscosity in the mouth than when examined in a viscometer at low rates of shear.

Higher viscosity non-Newtonian foods, such as Carnation evaporated milk and ice cream, do not exhibit turbulent flow; the only effect exerted by saliva is a reduction in viscosity on examination at all rates of shear. SAC

9 A 412

Economic applications of sweetness scales.

Moskowitz, H. R.; Wehrly, T.

*Journal of Food Science* 37 (3) 411-415 (1972) [17 ref. En] [Pioneering Res. Lab., US Army Natick Lab., Natick, Massachusetts 01760, USA]

A computer simulation of sweetness mixtures was made based upon empirical sweetness scales and experimentally derived models of sweetness additivity. 2 problems were investigated: total cost subject to maintaining overall mixture sweetness and its dual, total sweetness subject to maintaining the mixture's cost. Pairwise, mixtures of sucrose, glucose, fructose, sorbitol, sodium saccharin and sodium cyclamate were subject to analysis at a number of overall sweetness and cost levels. The results suggest that a computer scan of mixtures may yield specific mixtures satisfying cost or other types of constraints. IFT

9 J 1524

Dehydrated celery: effects of predrying treatments and rehydration procedures on reconstitution.

Neumann, H. J.

*Journal of Food Science* 37 (3) 437-441 (1972) [17 ref. En] [USDA W. Regional Res. Lab., Agric. Res. Service, Berkeley, California 94710, USA]

Dehydrated celery treated before air drying with either sucrose, dextrose, sorbitol, or glycerol had improved reconstitution characteristics, such as increased wt., larger size, fuller shape and a more tender, crisper texture, compared to dried untreated celery. Dried treated celery, prepared from frozen unblanched celery treated after thawing, and also from fresh raw material, rehydrated 43-218% and 21-26% respectively, more than dried untreated celery. When rehydrated samples (sucrose-treated and untreated) were redried and again rehydrated, treated celery rehydrated no better than untreated. However, water temp. used to originally rehydrate significantly affected successive rehydrations. Predrying treatments of water leaching, 1.5%  $\text{Na}_2\text{CO}_3$ , 0.5%  $\text{NaHSO}_3$  and/or 60% sucrose are also evaluated. IFT

9 L 657

Granular glucose.

Kroyer Kaisha Co. Ltd.

*British Patent* 1 267 363 (1972) [En]

Process and apparatus are described for the continuous production of granular glucose from solutions derived from starch hydrolysis. IFT

**Effect of oxidation of oils on deterioration of foods. II. Effect of food components on the oxidation of linoleic acid.]**

Goto, M.; Shibasaki, K.

*Journal of Food Science and Technology [Nihon Shokuhin Kogyo Gakkai-shi]* **18** (6) 277-283 (1971) [12 ref. Ja, en]

The following food components were added to linoleic acid-Celite system: glucose, sucrose, soluble starch, glycine, monosodium glutamate, peptone, and ovalbumin. Concn. of these components added were 0.1, 1.0, 5.0, and 10.0% of the linoleic acid. The model systems were stored at 30°C for 30-40 days. Thiobarbituric acid value and the change (increase at first and slight decrease later) in wt. were observed. Glucose, sucrose, and soluble starch had no effect even at higher concn. Glycine, monosodium glutamate, peptone, and ovalbumin had a protective effect on the oxidation. The presence of N compounds caused yellowish coloration and unpleasant smell, which differed from the rancid smell caused by the oxidation of linoleic acid. There were some differences between the effects of the various components on the wt. change. SKa

P 1346

**Alternatives to milk powder in ice cream recipes.**

Rowhurst, B.

*Ice Cream and Frozen Confectionery* **24** (5) 294-296 (1972) [En]  
In this second article on the subject, ice cream mixes are suggested which contain the min. legal quantity of 7.5% milk SNF. The other solids required to 'balance' the mix are obtained by using glucose and powdered dextrose. Mixes are given for use in soft-serve, vertical, horizontal batch and continuous freezers. JR

G 509

**Packaged dry mixes.**

News, H. J.; Raffensperger, S. P. (White Lily Foods Co.)

*United States Patent* **3 671 264** (1972) [En]

Packaged dry mixes contain artificially flavoured lumps, the major ingredients functioning in the formation and texture of these lumps being high mp hydrogenated vegetable fat, pregelatinized starch, glucose and dextrose. The lumps are formed by molding and extrusion. IFT

H 1535

**Development of sugars during malting. Relations with tannin substances and reducing agents.]**

Perpentier, J.-P.

*OS* **1972** (6) 244-251 (1972) [7 ref. Fr]  
Laboratoire Soufflet, Nogent-sur-Seine-10, France]  
The tannin, reducing substance and sugar contents of aqueous extracts of barley meal and

malt were measured, and a micro-malthouse is described. With 30 samples of barley, there was a positive correlation between tannin and reducing substance contents but no correlation between tannin and sugar contents. With 3 micromalts, the contents of fructose, maltose, glucose and sucrose tended to increase with increasing tannin content. During malting, the sugar content of the barley increased on the 2nd day of germination, remained fairly constant up to the 4th day and then increased markedly on the 5th-7th days. MEG

10 H 1566

**[Model experiments on storage of wine distillates, with particular reference to effect of oxygen and wood extractives.]** Modellversuche zur Weindestillatlagerung unter besonderer Berücksichtigung des Sauerstoffeinflusses und der Holzextraktstoffe.

Haeseler, G.; Misselhorn, K.; Underberg, P.-G.  
*Branntweinwirtschaft* **112** (9) 204-213; (10) 229-239; (11) 261-270 (1972) [106 ref. De]

The following tannin components were separated by TLC: coniferol, salicylaldehyde, ferulaldehyde, protocatechualdehyde, vanillin, syringaldehyde, hydroxymethylfurfural, salicylic acid, p-coumaric acid, gallic acid, chlorogenic acid, scopoletin, camphorol, quercetin, morin, quercitrin, gallo catechin. 2 compounds (an aldehyde and a catechin-like substance) could not be identified. Glucose, arabinose, rhamnose, xylose and fructose were also identified. Semiquantitative evaluation of the thin layer chromatograms enabled a fairly accurate estimation of the storage life to be obtained, providing the storage conditions were known (this applies only to the barrel sizes involved in these experiments). TUB-IGB

10 H 1589

**[The rate of inversion of sucrose in must.]** Über die Inversionsgeschwindigkeit der Saccharose im Most. Weger, B.

*Mitteilungen: Rebe, Wein, Obstbau und Früchteverwertung* **21** (6) 435-438 (1971) [13 ref. De, en, fr, es]

Saccarification of must is discussed and reviewed with reference to legislative requirements. Must samples containing increased amounts of sucrose were stored at 4°, 15° and 25°C and processed by paper chromatography after 2, 5, 9, 24, 36 and 48 h. The rate of inversion was found to be related to temp., large amounts of sucrose being inverted within a short time. New wine containing 6.3 g/l. of reducing sugar gave a glucose:fructose ratio of 1:1. OA

10 J 1564

**Utilization of corn-sugar in canned vegetables.** Begum, J. A.; Weckel, K. G.

*Pakistan Journal of Scientific and Industrial Research* **14** (4/5) 405-410 (1971) [10 ref. En]



[Dept. of Food Tech., E. Pakistan Agric. Univ., Mymensingh]

The effects of corn sugar (Cerelese brand) on the colour properties, texture qualities and flavour acceptability of 5 different canned vegetables (peas, sliced beets, lima beans, cut yellow beans and whole kernel corn) were studied. Canned vegetables were processed with brine solutions containing various proportions of sucrose and Cerelese at 2 different levels of sugar solids (2.5 and 5.0%). Measurements of drained wt., texture and colour were made after the equilibration of the canned vegetables at 40°F and 90°F for various periods. The drained wt., and shear press readings of certain vegetables were increased when corn sugar was used in the brine. Hunter colour values L (lightness), aL (redness) and bL (yellowness) of all the vegetables were affected when sucrose was replaced by dextrose in the brine. Dextrose caused slight to moderate effects when used at 25% replacement of sucrose and greater effects when used in quantities up to 100% replacement. The flavour of the canned vegetables was affected but little by the presence of dextrose in the brine. AS

10 L 729

[**Determination of granulometric composition of glucose massecuite crystals.**]

Tregubov, N. N.; Khvorova, L. S.

*Sakharnaya Promyshlennost'* 45 (8) 53-57 (1971) [2 ref. Ru] [MTIPP, USSR]

The 3 commonest determination methods are compared, viz: sifting, sedimentation and microscopical examination. The sifting analysis is rather exacting; the sedimentation method must cope with the difficulty of finding a suitable solvent; the microscopical method is most suitable for determination of granulometric composition of glucose crystals in the massecuite. The technique of the last determination method is presented. Granulometric composition of the massecuite crystals as they exist towards the end of the crystallization process is only slightly different from that of common glucose crystals. STI

10 L 731

[**Some physical properties and structure of aqueous saccharide solutions.**]

Burdukova, R. S.; Dadenkova, M. M.

*Pishchevaya Promyshlennost'* 1971 (12) 20-24 (1971) [12 ref. Uk]

Results are presented of a study of physical properties of aqueous solutions of arabinose, fructose, glucose, sucrose and raffinose, and the structure of these sugars is discussed; values obtained by measurement of light dispersion in the solutions under study exhibit a negative deviation from ideal values. Physical properties of all the solutions studies are analogous as regards concn. dependence. STI

10 L 733

**Fruit leather - Mid-East treat.**

Anon.

*Manufacturing Confectioner* 52 (5) 38-40 (1972) [En]

A description is given of the preparation and packaging of fruit leather, a Middle East confection, now being introduced into the USA. Fruit paste, consisting of fruit, sugar, corn syrup solids and preservatives, is flattened into thin 10 in diam. discs. The cellophane carrying the discs of fruit leather is cut into individual pieces and the product is dried on racks. These chewy candy discs are produced in 5 flavours (apricot, strawberry, prune, raspberry and apple). The product is distributed flat and in bulk quantities to stores where the discs are separated, and rolled into tubes or cones for display and sale. VJG

10 M 1076

[**The hemicelluloses of rye grain.**] Über die Hemizellulosen des Roggenkorns.

Holas, J.; Hampl, J.; Piemanova, B.

*Getreide, Mehl und Brot* 26 (5) 144-148 (1972) [37 ref. De] [Forschungsinst. der Mühlen- und Backwarenind., Chem.-Tech. Hochschule, Prage, Czechoslovakia]

Rye hemicellulose was fractionated by elution from a DEAE-cellulose column with H<sub>2</sub>O, 0.01M, 0.1M and 0.5M borate, and 0.5N NaOH. After acid hydrolysis and neutralization, the component sugars were separated by paper chromatography, using 2:1:2 ethyl acetate:pyridine:water as developing solvent, and estimated by densitometry after reaction with aniline oxalate. The polysaccharide content of the fractions, in order of elution, was 100, 100, 94, 82 and 71%, the remainder being protein. Glucose, arabinose, xylose and galactose were detected in the polysaccharides, and their relative proportions in each fraction are tabulated. DSW

10 M 1081

**$\alpha$ -Glucosidase and leavening of baker's yeast.**

Suomalainen, H.; Dettwiler, J.; Sinda, E.

*Process Biochemistry* 7 (5) 16-19 & 22 (1972) [51 ref. En] [Production & Chem. Res., Finnish St. Alcohol Monopoly (Alko), Helsinki, Finland]

The  $\alpha$ -glucosidase (maltase) activity of a number of baker's yeast samples was estimated using p-nitrophenyl- $\alpha$ -D-glucoside as a substrate. The estimation was carried out with both intact and disintegrated yeast cells. No correlation was found between  $\alpha$ -glucosidase activity and leavening ability or the ability of the yeast to ferment maltose. GLC of dough sugars during proofing showed that glucose, fructose, sucrose and raffinose are fermented before maltose. Addition of glucose, sucrose or maltose during leavening showed that the first 2 sugars improved leavening especially during the 1st h. but maltose impaired the process. Addition of invertase,  $\beta$ -amylase and  $\alpha$ -1,4-amyloglucosidase was investigated but only the latter enzyme had any influence on CO<sub>2</sub>



duction. Although gas production was increased, the dough became unusable because of changes in consistency. WHCA

M 1083

**Laevulose-containing corn syrups for the baker.**

Edferm, S.; Hickenbottom, J. W.

*Bakers' Digest* 46 (2) 26-27 & 30-31 (1972) [6

f. En] [Fleischmann Lab., Stamford,

Connecticut, USA]

The properties and uses of laevulose-containing corn syrups and other sweeteners are reviewed and compared. Information is given on commercially available dry and liquid sweeteners, their relative sweetness value and composition, critical handling data, effect of sweeteners on proof time in continuous mix bread, and sweet dough absorption corrections for inversion of sucrose. The main functions of sweeteners in fermented doughs and bread, and in non-yeast leavened products, together with cost considerations are discussed. OA

M 1106

**The protein of wheat aleurone cells.]** Das Eiweiss

der Aleuronzellen des Weizens.

Schürlich, M.; Friedel, K.

*Lebensmittelwissenschaften* 59 (5) 216-217 (1972) [5

f. De] [Kurt-Hess-Inst. für Mehl- und

Weissforschung, Munich, German Federal

Republic]

Contents of wheat aleurone cells, isolated by digestion from a CCl<sub>4</sub>-benzene mixture of sp. 1.5, included 30-35% protein, ~35% minerals (P, Mg, Ca) and carbohydrates. Amino acid analysis showed aleurone protein (AP) to be more similar to starch-bound protein (SP) than to free protein. AP and SP could be differentiated by disc electrophoresis. AP was ~50% soluble in water. The soluble and insoluble fractions had the same amino acid composition, but the former was partially associated with glycoprotein, containing glucose, mannose and galactose, while the latter was associated with phytin P. DSW

P 1554

**Contribution of specific saccharide fractions of corn syrup to the syrup flavour of ice cream mix.**

Samani, A.; Leeder, J. G.

*Journal of Food Science* 37 (2) 328-330 (1972)

[ref. En] [Dept. of Food Sci., Rutgers St. Univ.

New Jersey, New Brunswick, 08903, USA]

Saccharide components of a 43/36 dextrose equivalent (DE) corn syrup were isolated in quantity into 3 fractions: (i) was soluble in 95% ethanol, while (ii) and (iii) were groups of fractions separated by gel permeation chromatography on G-10-Gel P-2. Group (ii) contained saccharides of DP 10, while (iii) included those of DP 1-4 together with some higher saccharides. 5 ice cream mixes containing 11% milk SNF, 11% milk fat and 11% sweetener were made. The control contained sucrose as the only sweetener, the standard mix had

40% of the sucrose replaced by 36 DE corn syrup, and in the remaining 3 mixes, 40% of the sucrose was replaced by (i)-(iii), respectively. Organoleptic assessment of 10% solutions of (i)-(iii) and the corn syrup compared to sucrose solutions showed a significant statistical difference between them: (i) was ranked as closest in sweetness to sucrose; (ii) ranked least sweet 80% of the time; (iii) ranked midway between the sucrose and corn syrup. Of the ice cream mixes, (i) had the most pronounced "syrup" flavour. For the other sweeteners, the syrup flavour score results differed significantly from the sweetness results. (ii) ranked 3rd 88% of the time, (iii) ranked last 88% of the time, with the corn syrup mix ranking 2nd. JR

10 P 1619

**New imitation cheeses are versatile.**

Dietz, J. H.; Ziemba, J.

*Food Engineering* 44 (7) 60-61 (1972) [En] [Int.

Venture Res. Div. of Peavey Co., Chaska,

Minnesota, USA]

The production of low-cost imitation Cheddar and blue cheeses is outlined. The major dry ingredients, wheat flour, solids (whey, buttermilk and corn syrup) and soy flour, are weighed, and conveyed into a 500-lb capacity blender. Melted shortening is then added along with minor ingredients (salt, imitation cheese flavour, xanthan gum, food colouring etc.). The batch is thoroughly blended for ~15 min; it is then bottom-discharged to a vibrating hopper. From the hopper the dry mix is passed into a modified meat grinder fitted with a plate containing twenty-four  $\frac{1}{4}$  in. square dies and a double-bladed rotary knife. Extrusion is at the rate of 400-500 lb/h. The  $\frac{1}{4}$ " cubes discharged from the extruder are cooled and bulk-packaged in polyethylene-lined corrugated cartons. The cubes are already being used in salad garnishes. Potential applications include baked goods and dressings. AB

10 Q 143

**[Dry egg product]**

Liot, R.; Liot, M.

*French Patent* 2 063 536 (1971) [Fr]

To a liquid egg product is added  $\geq 1$  sucroglyceride, e.g. of palm oil, lard, tallow, copra, maize or soya, or  $\geq 1$  sucrose fatty acid ester, e.g. sucrose mono- or distearate, sucrose mono- or dipalmitate, sucrose mono- or dilaurate, or sucrose mono- or dioleate. The additive constitutes 0.05-10.00% by wt. in the case of whole egg or yolk and 0.005-0.500% in the case of egg white. A carbohydrate, e.g. glucose or sucrose or a mineral salt, e.g. NaCl, may also be added. The mixture is then dried conventionally, optionally after pasteurization. The products, which are used in biscuit manufacture, or for the preparation of desserts, sauces, or dietetic products, rehydrate easily and without curd formation, and give emulsifying and whipping qualities similar to those of fresh eggs. W&Co



10 R 578

**Studies on the control of the denaturation of fish muscle proteins during frozen storage. I. Preventive effect of sodium glutamate.**

Noguchi, S.; Matsumoto, J. J.

*Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi]* **36** (10) 1078-1087 (1970) [24 ref. En, ja] [Dept. of Chem., Sophia Univ., Chiyoda-ku, Tokyo, Japan]

Effect of monosodium glutamate on frozen storage denaturation of fish muscle actomyosin was studied by an in vitro model test on isolated actomyosin in addition to a frozen storage test using washed minced fish. In addition to the sodium glutamate-free control group, glucose-added and urea-added groups were examined for comparison. In the model test, 0.3M sodium glutamate was found as effective as or even better than 1M glucose in preventing denaturation of actomyosin using data on solubility, viscosity, ATPase activity and ultracentrifugal patterns. Little difference was noted between tests carried out in 0.6M KCl and those in 0.05M KCl. Addition of urea promoted denaturation. In 0.6M KCl, the effect of sodium glutamate approached the max. beyond 0.025M (0.42%). Kamoboko jelly made from frozen minced fish with added sodium glutamate was better than that of the control group in keeping qualities as measured by the jelly strength, folding test and the amount of expressible water, and also by amount of soluble proteins. Results suggest the applicability of the model test for screening additives for preventing freezing denaturation, as well as for studying its mechanism. AS

10 T 580

**Sodium-free salt substitute.**

Cumberland Packing Corp.

*British Patent* 1 275 540 (1972) [En]

Salt substitutes comprise mixtures of potassium and/or ammonium chloride, cream of tartar, and lactose or dextrose. IFT

11 E 426

**[Process for preserving fruit.]**

Etudes de Techniques Nouvelles & de leurs Applications

*French Patent* 2 079 776 (1971) [Fr]

The qualities of freeze-dried fruit, particularly resistance to ambient humidity, are improved by addition of 5-20% by wt. of glucides, e.g. glucose, fructose, sucrose, lactose, maltose, dextrans, or starch, before drying. The freezing temp. is  $-40^{\circ}\text{C}$  with freeze-drying at  $-25^{\circ}\text{C}$  and 0.5 Torr. If the product is a baby-food, the mixture is subjected immediately before drying to flash pasteurization. The finished product is packaged, under an inert atm. or vacuum, in flexible air- and moisture-proof containers. The process may also be applied to dairy products, e.g. yoghurt. W&Co

11 J 1752

**[Effect of heat treatment on the proteins of green peas. Variation in essential amino acid content.]**

Segal, R.; Motoc, D.

*Industria Alimentara* **21** (3) 137-140 (1970) [16 ref. Ro, en, fr, de, ru] [Inst. Politehnic, Galati, Roumania]

Green peas were packaged in 400-ml glass jars in 2% brine (pea:brine ratio, 60:40) with or without addition of 5% glucose or sucrose and heated for 1, 2 or 3 h at  $100^{\circ}\text{C}$  or for 0.5, 1 or 2 h at  $120^{\circ}\text{C}$ . Initial and final essential amino acid contents determined by paper chromatography are tabulated as well as essential amino acid (EAA) indices [Oser, J. Am. diet. Ass. (1951) **27**: 396]. EAA losses increased with increase in temp. and treatment duration and were most marked for arginine, lysine, histidine and methionine in that order; losses were higher in the presence of glucose and, to a lesser extent, sucrose. SKK

11 L 836

**How to make sugar confectionery using invert sugar or acids without the use of glucose syrup or reduced amounts of glucose syrup.**

Silesia Gerhard Hanke KG

*Confectionery Production* **38** (4) 199, 201-202 & 204; (5) 247-248, 250 & 258 (1972) [En] [4041 Norf, German Federal Republic]

A historical review and an outline of modern cooking methods are given. The following aspects are then considered: the cooking of high boilings in general and also using raw materials to replace glucose syrup; cooking with the addition of cream of tartar; production of standard invert-sugar using phosphorous acid; invert sugar syrup produced by addition of lactic or citric acid; invert syrup, produced by addition of chemically pure HCl, free of As, having 80% sugar content; basic rules for the use of glucose syrup, standard invert sugar and cream of tartar for sugar boiling using different cooking methods. For the latter, reference is made to the Silesia Confiserie Manual No. 1, Handbook for the Sugar Confectionery Industry [see FSTA (1970) **2** 3L146]. VJG

11 U 745

**Peanut butter.**

Standards Association of Central Africa

*Central African Standard* CAS No. S31: 1971 17pp. (1971) [En] Price \$0.90 [PO Box 2259, Salisbury, Rhodesia]

This specification covers the requirements for smooth and crunchy peanut butter. Ingredient requirements cover: condition of ingredients, peanuts, salt, sweetening ingredients (sucrose, dextrose, liquid glucose, invert sugar, honey), and preservatives (antioxidants). General requirements include:  $\geq 90\%$  peanut content; good flavour and aroma, typical of freshly roasted peanuts, free from staleness, rancidity and objectionable flavour and odour; good bright colour, typical of roasted

nuts; suitable stabilization to minimize oil  
aration; and free from foreign matter, dirt and  
rganic residue, and fairly free from brown/black  
coat particles and scorched or discoloured  
nut tissue. Requirements are listed for texture,  
robiology (including aflatoxins), containers  
es and condition), packing and processing  
ing, exterior of containers, storage), labelling  
l marking, and sampling. Appendices give  
ethods for determination of vacuum and net mass  
contents, fill of container, and aflatoxin, and for  
ubation for microbiological examination. JA

H 1935

process for the production of a tea substitute.

jjatullah, S.

*Pakistan Patent* 122 107 (1971) [En]

A tea substitute is produced from *Melissa  
cinalis*. The leaves are separated from the stalks,  
lead over a cloth or wire tray and bruised. Liquid  
cose and bakers' yeast are added, and after  
mentation, the leaves are roasted. W&Co

1890

Industrial production of potato chips to be stored  
en.]

nbaud, M.

*French Patent* 2 049 573 (1971) [Fr]

Washed, peeled, chipped and sorted potatoes are  
hed in weak sulphite solution containing 0.2 -  
g SO<sub>2</sub>/l and <3 g of citric acid/l., then blanched  
5-75°C for 2-10 min according to the quantity  
size of chips, e.g., 70°C for 5 mins for  
ditional" 1 cm<sup>2</sup> cross-section chips, in a similar  
tion but containing at least 0.2 g/l. citric acid as  
as heavy metal, especially Fe, sequestrants.  
s allows effective action of the natural pectolytic  
ymes, avoids a rubbery texture appearing after  
ing and destroys the phenoloxydases which  
ld cause browning in air. After partial cooling  
passing rapidly through tepid solution, the chips  
cooked in a weak solution of SO<sub>2</sub> and citric  
(<0.5 g/l. of each) at 82°C for 10 min. This  
ompletes the gelling of the starch and destruction  
he phenoloxydases. The chips are next  
ersed for some min in a solution of 20-40 g/l.  
ucose with colourant. This raises the glucose  
tent to that necessary for rapid development of  
Maillard reactions and caramelization. Frying is  
age, first in mixed liquid and solid fats at 160°C  
3-4 min, next in liquid fat to which 0.5 - 4.0  
s/1000 antioxidant are added, at 75-80°C for 2  
. Draining is performed on a vibrating table  
le the chips are maintained at >50°C by IR  
ation. W&Co

888

rose icings.

n, H. E.; Kimball, B. A.; Godzicki, M. M.  
C International Inc.)

*United States Patent* 3 676 155 (1972) [En]

ings have improved skin-forming and texture

properties consist of 5-20% granulated sucrose, 20-  
45% crystalline dextrose hydrate, 40-50% powdered  
dextrose, ≤5% water, 2-5% shortening and ≤5%  
flavouring etc. The icings are particularly suitable  
for wrapped products. IFT

12 L 897

[Transparent candy.]

Corn Products Co.

*Japanese Patent* 22 270/72 (1972) [Ja]

Transparent candy is prepared from  
electrodialyzed starch hydrolysate syrups. IFT

12 L 898

[New method to produce liqueur fillings for  
confectionery.]

Talanova, V. I.; Chernogulov, G. I.

*Khlebopekarnaya i Konditerskaya Promyshlennost'*  
16 (2) 36-38 (1972) [Ru] [Leningradskii Nauchno-  
issled. Inst. Pishchevoi Promyshlennosti, USSR]

Present method of preparing liqueur fillings is  
described and also a new technological process  
together with a mechanized production line. Sugar-  
containing syrup is piped over long distances. In  
order to eliminate crystallization of the syrup  
during pumping, 3% of starch syrup is added at  
completion of boiling the sugar syrup. Flavourings  
are added by a dosing pump. The syrup is poured  
into starch moulds at 50-55°C and 5-6% moisture.  
The fillings are allowed to stand for 2 h at 20-22°C;  
the new method eliminated this. Special trays were  
designed for filling. The line performance is 800 kg  
fillings/shift. STI

12 L 936

New starch hydrolysates spur product development.

Murray, D. G.; Ziemba, J. V.

*Food Engineering* 44 (5) 88-90 (1972) [En]  
[Grain Processing Corp., Muscatine, Iowa, USA]

5- and 30-DE (dextrose equivalent) spray-dried  
corn starch hydrolysates and 36- and 42-DE high-  
maltose corn syrup solids are described. The DE,  
max. moisture (%), pH, bulk density, dextrose,  
maltose, maltotriose, and tetrasaccharide contents,  
sweetness, and solubility (80°F) are given for 10  
starch hydrolysates. Uses in frozen chicken chow  
mien, frozen cheese and white sauces, doughs,  
frozen cakes, freeze-dried citrus powders, and new  
coating uses are described briefly. High dextrin  
contents are used to increase viscosity and reduce  
sweetness, while high maltose solids reduce  
browning and stabilize moisture equilibrium.  
WHCA

12 L 956

Newest natural sweetener: dextrose-levulose syrup  
from dextrose.

Kooi, E. R.; Smith, R. J.

*Food Technology* 26 (9) 57-59 (1972) [20 ref.  
En] [Biochem. Res. Dept., CPC International Inc.,  
Moffett Tech. Centre, Box 345, Argo, Illinois]



60501, USA]

The development of a commercially feasible new dextrose-laevulose syrup by the enzymatic isomerization of dextrose has been achieved by CPC International Inc., Argo, Illinois. This syrup from dextrose is a purified aqueous solution containing 45% laevulose and is chemically and functionally comparable to traditional syrups. The raw material used is domestic corn. The syrup provides a new source of sweetener equivalent in nutritive value and microbiological stability to carbohydrate sweeteners presently available in the USA. AA

12 T 690

**[Production of locked-in natural fruit flavours for food carriers.]**

Karwowska, K.; Krajewska, K.; Geca, Z.

*Prace Instytutów i Laboratoriów Badawczych Przemysłu Spożywczego* 21 (4) 423-450 (1971)

[22 ref. Pl, ru, en] [Inst. Przemysłu Fermentacyjnego, Warsaw, Poland]

A method was developed for incorporating essential oils from fruit and berries in food carriers. Pure carbohydrates were used as carriers or their mixtures e.g. starch syrup, sucrose with starch sugar addition, sorbitol. The suitability of an addition of lecithin, glycerol and pectin as emulsifiers in the melted carrier was studied. Based on laboratory experiments 2 procedures for pilot scale operation were developed using sucrose and starch or sorbitol as carriers. Pilot scale processing equipment was constructed to manufacture 35 kg essential oil/day in 2 shift operations. The flavourings obtained had favourable organoleptic properties, low water content and were easily soluble. The finished products contained approx. 3.4% of the flavouring matter. The flavourings will be used mainly for powdered fruit juices. STI

12 U 797

**Food Additives and Contaminants Committee report on the review of the Preservatives in Food Regulations 1962.**

United Kingdom, Ministry of Agriculture, Fisheries & Food

89pp. SBN 11 240863 x (1972) [En] London, UK: H.M. Stationery Office Price 57p

A review of the Preservatives in Food Regulations (S.I. 1962 No. 1532) is presented. Subjects dealt with include: Antibiotics i.e. regulations concerning the use of tetracyclines, nisin, nystatin and pimarcin; Applications for preservatives not currently permitted, which should be rejected, these being, octyl gallate, formic acid, hexamethylenetetramine, nordihydroguaiaretic acid, metatartaric acid, mixture of fumaric acid and sodium benzoate; benzoyl peroxide and diethyl pyrocarbonate; The currently permitted preservatives and extended uses i.e. sorbic acid, SO<sub>2</sub>, benzoic acid, para-hydroxybenzoates, propionic acid, diphenyl, copper carbonate, ortho-phenylphenol and its esters, and formaldehyde;

CO<sub>2</sub> when used in packing food; Thiabendazole; Ethylene oxide; Nitrate and nitrite in food; and Preservative in beer. Also covered are: definitions of sauces, sausage and sausage meat, flavouring syrup and flavouring emulsion, sugars and glucose syrup, and flour confectionery; use of preservatives in canned tomatoes and canned fruit; preservatives content of glucose drinks; waxing of fresh fruit; and labelling of preservatives. Summaries of the committee's conclusions and recommendations are tabulated. The following 3 appendices are included: List of organisations who gave information or made representations; Specifications for preservatives in food; and Programme of research into nitrosamines, nitrates and nitrites. 2 annexes detail the Report of the pharmacology sub-committee and the Report of the antibiotics panel. AA

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J. NEWTON  
ASSISTANT EDITOR





[Sake production.]

**Japanese Patent 26 711 72 (1972) [Ja]**

In a continuous process, refined sake is obtained by fermenting glucose with yeast, the glucose being added gradually to the fermentation system. IFT

**2 J 279**

Measurement of ice cream texture with the constant speed penetrometer.

Tanaka, M.; Pearson, A. M.; deMean, J. M.

*Canadian Institute of Food Technology Journal* 5 (2) 105-110 (1972) [13 ref. En, fr] [Dept. of Food Sci., Univ. of Guelph, Ontario, Canada]

A constant speed penetrometer was used to evaluate ice cream firmness. The cones of the penetrometer were found to give curves that could be used to calculate the yield value and apparent viscosity of the ice cream. Variations in air content, or overrun, were inversely related to both the yield value and apparent viscosity. Samples containing (i) 15% sucrose, (ii) 10% sucrose, 5% maize syrup solids, (iii) 5% sucrose, 10% maize syrup solids, (iv) 15% maize syrup solids and (v) 15% dextrose showed that the greater the  $\beta$  depression the lower was the yield value. Organoleptic ranking of firmness was related to the yield values. W&Co

**1 U 55**

Standard for glucose syrup (liquid glucose).

Malaysia. Standards Institution of Malaysia

*Malaysian Standard MS 3.7:1971* 14pp. (1971).

[En] [Kuala Lumpur]

Glucose syrup shall be clear, transparent, free from foreign matter and conform to the following requirements: TS, min. 27.5; dextrose equivalent, min. 42; ash, max. 0.05%; sulphated ash, max. 0.05%; acid value, max. 1.0; pH, max. 5.5; reducing sugar, max. 45%; As, max. ppm 10; Pb, max. ppm 2; Cu, max. ppm 2.0.

Specimens for sampling and marking should be prepared in accordance with the samples for analysis. The method of TS by vacuum distillation and the method of As and Pb by gravimetric analysis. ELC

**2 A 66**

Process for obtaining dried fruit, particularly prunes.

Larrocche, J.; Larrocche, C.

*French Patent 2 098 889 (1972) [Fr]*

The fruit is immersed in a 30-50% by wt. aqueous

**2 J 279**

[Improved process for obtaining dried fruit, particularly prunes.]

Larrocche, J.; Larrocche, C.

*French Patent 2 098 889 (1972) [Fr]*

The fruit is immersed in a 30-50% by wt. aqueous solution of 60-70 parts by wt. sucrose, to which 30-40 parts glucose, dextrose, or invert sugar, in syrup form, have been added, at slightly  $<100^{\circ}\text{C}$ . The containers are then maintained at approx.  $80^{\circ}\text{C}$  for 10-15 h. This process is repeated consecutively with higher sugar concn. to approx. 65%, until the syrup has at least partially replaced the cellular liquids. The fruit is then dried conventionally. The syrup treatment may be carried out directly after picking and blanching, after several days and a 10-20% pre-dehydration treatment, or after long-term preservation with  $\text{SO}_2$ . In the latter case, all trace of  $\text{SO}_2$  is firstly removed by heating to  $80-85^{\circ}\text{C}$  at 500 mm Hg. Ideally, the end product should contain 65% DM. W&Co

**2 L 128**

[Process for the manufacture of confectionery products, particularly sweets.]

Generale Alimentaire

*French Patent 2 097 673 (1972) [Fr]*

Confectionery products, e.g. caramel, are made from a syrup containing sucrose and a starch hydrolysate,  $\geq 0.5$  of which consists of polysaccharides of  $>7$  glucose units and which has a dextrose equivalent of  $\leq 30$ . The syrup is cooked continuously and for a sufficiently short period to prevent formation of invert sugar. W&Co

**2 L 137**

[Effect of sugar and invert-sugar on the structure of foamed sugar confectionery.] Einfluss von Zucker und Invertzucker auf die Struktur von Schaumzuckerwaren. [Lecture]

Kruger, C.

*Süsswaren* 16 (8) 321-326; (9) 368-371 (1972)

[17 ref. De] [Anwendungstechnische Abteilung der Hildesheim Zucker-Vertriebsgesellschaft mbH, Braunschweig, Federal Republic of Germany]

The physical and chemical properties of sugar (particularly solubility, viscosity and crystallization characteristics) are generally modified during the manufacture of sugar confectionery by combination with other grades of sugar or sugar alcohols (invert sugar, dextrose, glucose syrup, sorbitol etc.). A detailed discussion is given of changes in the structure of foamed sugar confectionery from differences in sweetening power, solubility, bp and DM contents of the basic material. The effects of environmental RH on moisture uptake or loss by the product, and of viscosity (itself primarily a function of moisture content and temp.) on the whipping characteristics and stability of the basic mass are also described. IN





2 P 144

[Food based on cultured milk, and its preparation.]  
Blanchaud, M. (SICALY (Societe d'Interet  
Collectif Agricole & Lyophilisation))

*French Patent Application* 2 104 653 (1972) [Fr]

Yoghurt having an acidity of 8.0-9.5 g lactic acid/l. is frozen to -23° to -30°C within 30-60 min and freeze-dried under a vacuum of 0.2-0.5 mm Hg at -23 to -28°C and subsequently at 10-60°C. Before freeze-drying, 1-10% of dried milk, 1-10% of sucrose or glucose and/or fruit pulp may be added. The reconstituted yoghurt has a high content of microorganisms, the lactobacilli:streptococci ratio not being different from that of the original yoghurt. W&Co

3 L 182

**Phosphate content in glucose syrup conversion.**

Bhotiyakornkiat, V.; Birch, G. G.

*Process Biochemistry* 7 (12) 25-26 (1972) [7 ref. En] [Nat. Coll. of Food Tech., Weybridge, UK]

The type and concn. of P present in maize, wheat, rice and potato starches in relation to their hydrolysis to glucose syrups were studied. The P contents of the starches after various solvent extractions were (mg P/g): potato, 0.58-0.6; maize, 0.09-0.18; wheat, 0.41-0.59; rice, 0.31-0.64. The P contents of the glucose syrups and phosphorylase respectively from hydrolysis of the starches were: potato, 0.78 and 0.73; maize, 0.12 and 0.11; wheat, 0.50 and 0.42; rice, 0.59 and 0.45. It is concluded that the concn. and form of P in raw starch may be responsible for its resistance to hydrolysis. JN

3 L 192

**On-line control optimizes processing. I.**

Harden, J. D.

*Food Engineering* 44 (12) 59-62 (1972) [En] [Clinton Corn Processing Co., Clinton, Iowa, USA]

The selection of a control system for Clinton Corn Processing Company's plant for production of high-fructose sugar syrups in Clinton, Iowa, is discussed. A computerized system monitors automatic throughput in batch, continuous and semi-continuous operations. To meet system requirements, analogue and digital, pneumatic and electronic equipment and techniques have been employed. AA

3 P 316

**Biological behaviour of microbial lactases and the development of new foods from their application.**  
Wierzbicki, L. E.

*Dissertation Abstracts International*, B 32 (12) 6886-6887: Order no. 72-18 577 (1972) [En] [Cornell Univ., Ithaca, New York, USA]

Optimum pH for activity was found to be 3-5 for mould lactase and 5-7 for yeast and bacterial lactases, except for *Neurospora* with pH optima at 4.5 and 7.5. Optimum temp. for mould lactase was 55°C and for yeast and bacterial lactases, 40-50°C. Max. velocity of lactose hydrolysis in acid whey by lactase from *Aspergillus niger* occurred at 50% TS and 0.6% lactase concn., and was  $34.4 \times 10^{-6}$  mole/min/mg lactose with a Michaelis constant

(km) of 0.0628M lactose. 80-90% lactose hydrolysis was achieved using 1% enzyme in whey of 6% TS and 4% lactose content. At >6% TS, a side reaction resulted in the formation of 5 oligosaccharides, accounting for 1-2% of lactose. Up to 5 new foods were produced including a clear dark glucose-galactose syrup from hydrolysed acid whey. SAC

3 T 166

**Low-calorie sweeteners.**

LaVier, A. L.; O'Loughlin, R. L.; Walton, R. W. (E. R. Squibb & Sons Inc.)

*United States Patent* 3 704 138 (1972) [En]

Mixtures of hydrolysed corn starch, arabinogalactan and artificial sweeteners are in the form of granular, free-flowing solids similar in appearance to ordinary cane sugar. IFT

4 L 229

[Various-boiled sugar centres for dragees.]

Kreiter, K., Jr.

*Revue des Fabricants de Confiterie, Chocolaterie, Confiturerie, Biscuiterie* 47 (3) 20, 24, 27-28; (4) 19, 21-22, 24, 26, 28-29 (1972) [Fr] [Silesia  
Gerhard Hanke KG, Düsseldorf, Federal Republic of Germany]

Boiled sugar centres for dragees are classified as: (i) recrystallized (e.g. after-dinner mints); (ii) well cooked to provide a hard exterior wall with a liquid centre (e.g. liqueur chocolates); and (iii) molten caramel centres with a lining of fruit or chocolate. Recipe types given include: for (i) water, cream of tartar and high quality granulated sugar; for (ii) water; sugar, glucose syrup and 7% sorbitol; and for (iii) water, skim-milk, hard fat (cocoa butter), granulated sugar, brown sugar, glucose syrup (36-40 DE) and salt. In all cases flavourings and colours may be added to choice. LA

4 L 230

[New compressed pastilles.]

Slawatycki, A.

*Revue des Fabricants de Confiterie, Chocolaterie, Confiturerie, Biscuiterie* 47 (3) 29-30, 34-36, 38, 60 (1972) [Fr]

Improved pastilles prepared with ordinary compressing plant are obtained by addition of about 0.5% lubricant. It is prepared by coating the paste with lubricant before compression. Ingredients can include sucrose, dextrose, fructose, lactose, beet sugar, alcohols, glycerols, glucose syrup, carboxymethylcellulose, polyols, etc. Lubricants (stearic acid, calcium stearate, sodium stearate, talc) and colours and flavourings may be given for pastilles. The pastilles are not acidulated and the acidulated pastilles are obtained by dissolving the pastilles in water and use by drinking. LA





*French Patent* 2 112 564 (1972) [Fr]

The sugar composition of both mashes was studied by paper chromatography. Glucose and maltose were detected in saccharified mash, and glucose, citric acid, glycerin and succinic acid in fermented mash produced by the submerged mould culture method. Only glucose was detected in saccharified mash from the glucoamylase method, and products in fermented mash were the same as those in mould culture mash. Sugar composition of fermented mould culture mash was the same as that of glucoamylase mash. HK





Effects of type of sugar (glucose syrup or invert sugar), sodium citrate buffer scrap and residual water content on the quality of boiled sweets are considered. Effect of changing one operating factor on moisture content of high boilings and improvements in the design of continuous plants are also considered. VIG

Sucrose, glucose, isomenized sugar (from glucose to fructose), starch hydrolysate, sorbitol, and xylose were used for blending. Data are given in 28 tables. Not only sweetness but also good taste is important. SKa

Brief reports are given of the following papers presented at the conference held on 11-15 Oct. 1971 in Lerg, organised by the Central Professional German School for Sugar Confectionery:

- Contributing weight and decoration of dragees, by - Fiedler; Manufacture of special centres, by - Mannholdt; Manufacture of caramel centres, by - Mannholdt; Manufacture of gelatin based centres, by - Dupont; Properties of chocolate mass to be used in dragees, by - Haffelich; Different sucrose grades and their use in dragees, by - Kuyper; Influence and importance of other carbohydrates: glucose syrup, dextrose, fructose, starch, gum, milk, lactin, by - Volker; Flavouring and colouring of dragees, by - Peske; Method of producing dragees, by - Strick; Manufacture of almond dragees and pralines, by - Chamay; Use of pigments in dragee manufacture, by - Rothgang; Peeling of sugar solutions, by - Neumann; The Dosemat IDA 500 plant for dragee manufacture, by - Dumoulin; and The Dosemat 100 plant for dragee manufacture, by - Fiedler and Strick. RM

Results of sensory tests and staling showed that the most suitable proportions for castilla constituents were: sugar 1.0, weak flour 0.5 (or 0.6), egg 1.1, mizu-ame (glucose or corn syrup) 0.3, and water 0.2. These results agree with quantities used for castilla in Nagasaki. The function of the constituents was as follows: sugar improved the sp. vol. of castilla and controlled loss in wt. during storage at room temp. Egg did not improve the sp. vol. and the loss in wt. was large. Weak flour tended to improve the sp. vol. of castilla, but it was relatively small. It did not seem to affect changes in wt. of castilla during storage at room temp. Too much flour seemed to have an adverse effect on castilla flavour. Mizu-ame (glucose or corn syrup) did not improve the sp. vol. of castilla, but it controlled loss in wt.

Investigations into the relationship between foaming of castilla batter and quality of castilla were carried out with the following results. Addition of 0.5% surfactants (Span 80, Span 40, sucrose fatty acid ester, Tween 60), yolk, mizu-ame (glucose syrup), weak flour and cane sugar to egg white resulted in good stability and ability to foam except Span 80, Span 40, Tween 60, weak flour. The addition of mizu-ame to egg white is effective. Egg white gave good results. Microscopic observation on the foaming of castilla batter showed that castilla with the best external appearance and taste had batter with a foam which was stable and well dispersed regardless of uniformity in size. These conditions are satisfied by the mutual actions in the best blending of egg white, mizu-ame, cane sugar and yolk. [See preceding abstr.] AS





the blending order prescribes the action and quality of materials. Yolk does not affect the stability and it seems that cane sugar and yolk interact with each other. Mizu-ame affects the stability of batter foam and keeps castilla from staling. It can be said that the stability of batter foam and the staling of castilla are intimately related to each other.

AS

5 M 655

Dough preparation.

Sternberg, G. P.

*United States Patent* 3 713 844 (1973) [En]

A warm slurry of flour and malt or other amylase is digested to form a starch product, the bulk of which is reduced by evaporation to produce a condensed product which may be either a heavy syrup or a dried powder. This digested starch product is added to fermentable dough mixtures to produce compositions for bread and roll production. IFT

5 P 624

[Process for the manufacture of an acidified dairy product powder.]

Bohren, H. (Societe des Produits Nestle SA)

*Swiss Patent* 527 568 (1972) [Fr]

Dried yoghurt, which regains its natural consistency when rehydrated, is obtained by pasteurizing, concentrating to 35-40% TS and homogenizing fresh skim-milk. A portion (70-80%) of this milk is cooled to 6-8°C and maintained at this temp. The balance is diluted to approx. 21% TS, by addition of standardized, pasteurized milk or sterile drinking water, and inoculated with a yoghurt culture and incubated at 42-43°C to pH 4.2-4.4. It is then homogenized and cooled to 10-15°C. The 2 portions are injected simultaneously through separate nozzles into a common drying chamber at 60-70°C. The powder obtained is only partially acidified, and an acid, e.g. citric acid, lactic acid or an acid fruit concentrate is added in 10-100 µm grains. If the acid is liquid, it is incorporated in a solid support, e.g. glucose, sucrose or a protein material. The grains are coated with a fat of mp 50-52°C, preferably hydrogenated butter oil. To the fat may be added an antioxidant, e.g. tocopherol, butylhydroxyanisole, or butylhydroxytoluene, and an emulsifying agent, e.g. soya lecithin, glyceryl monostearate, or glyceryl polyricinoleate. Dissolution of the granules is then delayed and progressive. W&Co

6 G 285

Flavors disperse easily in bland, hydrolyzed cereal solids.

Arcon.

*Food Processing* 34 (1) 34 (1973) [En]

Details are given of the use of very bland, free-cholesterol, hydrolyzed cereal solids for dispersing highly concentrated imitation food flavours in dry cereals. The authors state that the problem of too much sweetness in cereal products is a major one in the cereal industry. The hydrolyzed cereal

solids product has a dextrose equivalent of 9-12; supplying nutritive bulk without affecting flavour or sweetness balance. Some of the typical formulations that use the hydrolysed cereal solids include: unsweetened mango flavoured beverage powder; soup pops, in chicken/celery, potato and potato/ham flavours; imitation dairy products; and imitation tomato juice mix. AA

7 A 314

A derivatographic study of the thermal decomposition of glucose.

Örsi, F.

*Acta Alimentaria Academiae Scientiarum**Hungaricae* 1 (3/4) 341-354 (1972) [6 ref. En]

[Dept. for Food Chem., Tech. Univ., Budapest XI, Hungary]

Thermal decomposition of glucose was studied in the Derivatograph of Paulik, Paulik and Erdey ensuring reproducible heat treatment. In the Derivatograph, changes taking place during heat treatment can be read off simultaneously recorded curves of sample weight, rate of weight change, temp. of sample and change in enthalpy. Information obtained from derivatograms, supplemented with results of analyses of volatile decomposition products and of the residue, have led to the following results. In a glucose sample mixed with twice its amount of alumina and heat at a rate of 6°C/min, formation of caramel begins at 165°C with the melting of glucose and at 240°C all the glucose is converted into caramel. In the temp. range 240-300°C the caramel colouring substance begins to pyrolyse, hence in the study of caramel formation this temp. range should be avoided as much as possible. Derivatograms of some intermediate products of caramel formation and of wheat starch, plotted under the same conditions as the derivatogram of glucose, suggest, in addition to the above findings, the formation of "reversion products" (polysaccharide) beside the colouring matter and the presence of 5-hydroxymethyl-furfural among the products volatilizing at 200°C. AS

7 L 572

Sweetness and sensory properties of dextrose-fructose-sucrose blends.

Brooks, G. A.; Warnecke, M. O.; Long, J. E.

*Abstracts of Papers, American Chemical Society*

165, AGFD 13 (1973) [En] [CPC International, Moffett Tech. Center, Argo, Illinois 60501, USA]

Syrups that contain 40-50% levulose and 50-60% dextrose are now being introduced to the USA food industry. These are made by the enzymatic isomerization of dextrose. The starting dextrose may be from crystalline dextrose or from the dextrose present in high dextrose equivalent corn syrup. Dextrose-levulose syrups alone and with added sucrose were compared to sucrose and medium invert for sweetness. Most of the tests described in this paper were performed on a dextrose-levulose syrup (55% dextrose-45% levulose) made from crystalline dextrose. Test systems were distilled water (10-25% sweetener solids) and





acidified, carbonated water (10-15% sweetener solids). The results showed a synergistic sweetness effect when sucrose, dextrose and levulose are present in the same solution. These and other results are discussed. AS

7 P 924

**The role of stabilizers in ice cream industry.**

[Review]

Muhammad Ramzan

*Science and Industry, Pakistan* 9 (1/2) 37-40 (1972) [9 ref. En] [West Pakistan Agric. Univ., Lyallpur]

7 P 962

**[Stabilization of cultured milk products with alginates.]** (In "Zbornik referatov z konferencie Nova technika a technologia vyroby kyslomliecnych vyrobkov a ostatnych mliecnych specialit".)

Boyle, J. L.

pp. 151-158 (1972) [Sk] Banska Bystrica, Czechoslovakia, Slovenska Vedeckotechnicka Spolocnost pre Potravinarsky Priemysel [Alginate Ind., London, UK]

In yoghurt manufacture, alginates (sodium alginate) may be added, preferably with admixture of sugar, to hot milk at approx. 90°C in concn. of  $\leq 0.3\%$  depending on the method of manufacture and consistency required in the finished product.

Alginates, e.g. propylene glycol alginate, may be used for stabilizing low TS tvaroh (e.g. 20%), suitable methods being to dissolve the alginate in whey, or mix it with 4-fold quantity of sugar and incorporate it into the product to obtain a concn. of about 0.2% in the finished product. Tables showing the effects of sodium alginate on the viscosity and syneresis of fruit yoghurt, and of propylene/glycol alginate on cultured dessert (11% fat) and tvaroh (approx. 19% TS) are given. FL

8 L 594

**Continuous conversion of starch to glucose by an amyloglucosidase-resin complex.**

Park, Y. K.; Lima, D. C.

*Journal of Food Science* 38 (2) 358-359 (1973) [6 ref. En] [Fac. de Tecnologia de Alimentos, Univ. Estadual de Campinas, Inst. de Tecnologia de Alimentos, Campinas, Brazil]

Amyloglucosidase obtained by submerged fermentation with *Aspergillus niger* NRRL 3122, was insolubilized by binding with an anion exchange resin (Amberlite IR-45). Conversion of liquefied starch into glucose by the enzyme-resin complex column is described. IFT

8 L 646

**Handbook of sugars for processors, chemists and technologists.** [Book]

Junk, W. R.; Pancoast, H. M.

xiii + 327pp. ISBN 0 87055 133 7 (1973) [many ref. En] Westport, Connecticut, USA, AVI Publishing Co. Inc. Price \$20.50 (USA) \$21.50 (Foreign)

A considerable amount of information of value to food manufacturers is given, on physical properties of sucrose and corn sugars, under the chapter headings: Sucrose (cane or beet sugars) (pp. 1-6, 16 ref.); Granulated sugar (pp. 7-18, 7 ref.); Liquid sugars (pp. 19-23, 2 ref.); Properties of sucrose liquid sugars (pp. 24-49, 11 ref.); Properties of invert and sucrose-invert liquids (pp. 50-66, 8 ref.); Specialty sugar products (pp. 67-71); Bulk handling of sugar (pp. 72-88, 2 ref.); Corn milling industry (pp. 89-94, 18 ref.); Manufacture of corn syrups and sugars (pp. 95-104, 18 ref.); Properties of corn syrups (pp. 105-156, 31 ref.); Properties of corn sugars (pp. 157-169, 11 ref.); [Continued in following abstr.] JN

8 L 647

**Handbook of sugars for processors, chemists and technologists.** [Book]

Junk, W. R.; Pancoast, H. M.

xiii + 327pp. ISBN 0 87055 133 7 (1973) [many ref. En]

[Continued from preceding abstr.] Handling and storage methods (pp. 170-180, 2 ref.); Analytical methods (pp. 181-187, 9 ref.); and Blends of sucrose, corn syrup and dextrose (pp. 188-224, 5 ref.). A series of appendices give: Canners' microbiological standards for sugar (with test procedures) (pp. 225-229); Standards and test procedures for 'bottler's' granulated and liquid sugar (pp. 230-234); Official methods of analysis of International Commission for Uniform Methods of Sugar Analysis (pp. 235-255); Standard analytical methods of the member companies of the Corn Refiners Association Inc. for corn syrup analysis (pp. 256-308); Standard analytical methods of the member companies of the Corn Refiners Association Inc. for corn sugars (pp. 309-318); and Analytical methods for corn syrup solids (pp. 319-320). A 7-pp. subject index is provided. JN

8 U 589

**Glucose syrup - determination of dry matter-refractive index method.**

International Organization for Standardization *International Standard ISO 1473-1973* (E). 13pp. (1973) [En]

This standard specifies a refractometric method for detn. of DM in glucose syrup or solid phase obtained by acid hydrolysis. The method is based on determination of the refractive index of an undiluted sample in a solution of known composition of the product. A correction factor may then be calculated from a series of standard refractive index values.





composition, conc. and temp. Instructions are given for expression of results and presentation of test reports, and an appendix gives the tables required for calculation of results. AJDW

9 U 613

[Liquid glucose.]

Bulgaria, Komitet po Kachestvoto,

Standartizatsiyata i Metrologiyata

*Bulgarian Standard* BDS 544-72 19pp. (1972)

[Bg]

This standard, which replaces BDS 544-58, applies to liquid starch for storage or industrial purposes, obtained by hydrolysis of corn starch. Physico-chemical requirements stipulated include: sp.gr at 20°C,  $\geq 1.430$ ; DM (by refractometry at 20°C),  $\geq 80\%$ ; reducing substances,  $\leq 42\%$  for sweets,  $\leq 43-58\%$  for confectionery; acidity,  $\leq 1.30^\circ$ ; free  $\text{SO}_2$ ,  $\leq 20$  mg/kg; total ash,  $\leq 0.3\%$ ; acid-insoluble ash,  $\leq 0.1\%$ ; pH,  $\geq 4.6$ ; caramel test,  $\geq 130^\circ\text{C}$ ; As salts,  $\leq 0.2$  mg/kg; Cu salts,  $\leq 12$  mg/kg; Pb salts,  $\leq 0.3$  mg/kg; Zn salts,  $\leq 10$  mg/kg; free mineral acids, no tolerance. The standard also covers sampling, testing, packaging, storage, shelf life (2 yr) and transport. HBr

10 L 786

[Starch hydrolysis and glucose reversion on an industrial scale.] [Review]

Ludvig, L.

*Elelmezési Ipar* 27 (6) 172-174 (1973) [11 ref.

Hu, ru, en, de] [Szczipari Kutató Intézet, Budapest, Hungary]

10 L 787

Some aspects of carbohydrate analyses by GLC techniques.

Sequeira, R. M.

*Journal of the American Society of Sugar Beet Technologists* 17 (1) 80-87 (1972) [10 ref. En] [Anstar Corp., Spreckels Sugar Div., Woodland, California 95695, USA]

The GLC analysis of carbohydrates was improved by using oxime or methoxime trimethylsilyl (TMS) derivatives. These required somewhat more sample preparation than simple TMS ethers, but produced less complicated chromatograms by reducing peak multiplicity due to elimination of formation of anomers. Once an appropriate derivative is selected for a particular mixture, limitations on analysis, especially of higher saccharides, are imposed by the ultimate volatility of the derivative and the chromatographic system (stability of the column and associated hardware in terms of temp. stability and freedom from leakage of carrier gas and sample). The analysis was applied to corn syrups and mixtures of corn syrups with sucrose and with 50% invert sugar, using columns of Dexsil 300. RM

10 L 792

The influence of glucose syrup and other carbohydrates on the physical properties and shelf life of caramels, toffees, fudge.

Jackson, E. B.

*Confectionery Production* 39 (4) 207-210 (1973) [En]

Major defects of toffees, caramels and allied products (graining, stickiness, loss of hardness, loss of shape or distortion) and their keeping properties are discussed with reference to the influence of carbohydrates. Recommendations are made to improve keeping properties and shelf life and include details of the most suitable glucose syrups available and suggested basic formulae. The main properties of regular, low DE (dextrose equivalent), high DE, high maltose/low dextrose and very high maltose glucose syrups are summarised. Dextrose and malto-dextrins are described and the role of various starches, including modified waxy maize starches, as texture modifiers is outlined. RM

11 L 827

[Factors affecting the opalescence of solutions of crystalline glucose.]

Ludwig, L.; Surjan, E.

*Szcszipar* 21 (2) 53-54 (1973) [Hu, de, fr]

[Szcszipari Kutató Intézet, Budapest, Hungary]

Opalescence in solutions of crystalline glucose monohydrate interferes with the chemical conversion into sorbitol and ascorbic acid. Material separated from the opalescent glucose solution contained 0.41% ash and 0.17% protein (on DM) whereas non-opalescent glucose solutions contained 0.0006% and 0.045%, respectively. Microbiological infection and the presence of mechanical contaminants (residues of filter substances) may be responsible for the opalescence. IF

12 A 525

[The structure of heat-formed esters from glucose and citric acid.] Zur Struktur der beim Erhitzen gebildeten Ester aus Glucose und Citronensäure. Maier, H. G.; Ochs, H.

*Chemie Mikrobiologie Technologie der Lebensmittel* 2 (3) 79-82 (1973) [3 ref. De, en, fr] [Inst: für Lebensmittelchemie, Westfälische Wilhelms-Univ., Münster, Federal Republic of Germany]

The reaction products obtained by melting glucose and citric acid have been analysed by TLC, ion exchange and gas chromatography. They proved to be acid esters. The 2 main components are, according to the mass spectra of their trimethylsilyl derivatives, monoglucose-monocitrates. The citrate residue seems to be attached to the  $\text{C}_6$  of the glucose. AS





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J. NEWTON,  
ASSISTANT EDITOR





1

**Potentiometric titration of chloride in corn syrup using the chloride ion electrode.**

Jacin, H.

*Stärke* 25 (8) 271-272 (1973) [5 ref. En, de, fr] [Res. and Development Div., Life-Savers Inc., N. Main St., Port Chester, New York 10573, USA]

A potentiometric method for determination of  $\text{Cl}^-$  in corn syrup was developed.  $\text{Cl}^-$  is titrated with  $\text{AgNO}_3$  and the end point determined by the chloride solid state membrane electrode. The method is suitable for normal and deionized corn syrups. Most common anions and oxidizing agents do not interfere, but sulphide ions must be absent and cyanide and iodide present in traces only.  $\text{Cl}^-$  ion level must be  $\geq 300 \times$  the bromide,  $100 \times$  the thiosulphate and  $8 \times$  the  $\text{NH}_3$  level. Analysis of a corn syrup gave 1.09-1.10 mg  $\text{Cl}^-/\text{g}$  dry solids, SD 0.0056, relative SD 0.511% for 6 determinations. Recovery of added  $\text{Cl}^-$  was 97.1-100.8% on 3.77 mg. Analysis of 6 syrups gave 0.03 (deionized syrup) to 1.31 mg  $\text{Cl}^-/\text{g}$  solids. RM

2

**Chemical and physiological properties of glucose syrup components.** [Lecture]

Birch, G. G.; Etheridge, I. J.

*Stärke* 25 (7) 235-238 (1973) [14 ref. En, de, fr] [Nat. Coll. of Food Tech., Weybridge, Surrey, UK]

3

**Determination of silica in corn syrup.**

Jacin, H.

*Stärke* 25 (9) 309-311 (1973) [7 ref. En, de, fr] [Res. & Development Div., Life-Savers Inc., North Main St., Port Chester, New York 10573, USA]

A method for determination of Si in corn syrup is described using formation of a silicomolybdate complex ( $\text{SiO}_2 \cdot 12\text{MoO}_3$ ) which upon reduction with 1-amino-2-naphthol-4-sulphonic acid gives a heteropoly blue which absorbs at 810 nm. Interfering phosphomolybdate is neutralized by addition of oxalic acid. The method is accurate for 0.1-1.0 mg Si/ml. Repeated analysis of a corn syrup gave 17.8  $\mu\text{g}$  Si/g solids with SD 0.06, relative SD 0.34% for 9 determinations. Recovery of added Si was 99-103%. Analysis of 5 corn syrups showed 12-22  $\mu\text{g}$  Si/g solids. RM

4

**Carbohydrate Chemistry - VI. Plenary lectures presented at the VIth International Symposium on Carbohydrate Chemistry held at Madison, USA, 14-18 August 1972.** [Book]

International Union of Pure & Applied Chemistry 131-208pp. ISBN 0 408 70525 6 (1973) [many ref. En] London, UK, Butterworths

The history of the marketing of carbohydrates, including cane sugar, glucose, and other specialist sugars is reviewed. JN

5

**[Using sugar syrup for the production of ice cream.]** Chernyak, V. A.

*Kholodil'naya Tekhnika* No. 2, 45 (1973) [Ru] [Moskovskii Khladokombinat No 7, USSR]

In the Moscow Refrigeration Combine, sugar syrup with 64-67% DM content is used for the production of ice cream instead of granulated sugar. If slowly cooled, the sugar syrup does not set for several days. A scheme for unloading syrup from tankers and storage is included. The introduction of sugar syrup saved 14 000 r in the production of 12 000 t of ice cream/yr. It makes the full mechanization of sugar handling operations possible. STI

6

**[Method of obtaining crystallized  $\alpha$ -dextrose anhydride.]** Verfahren zur Gewinnung von kristallisiertem  $\alpha$ -Dextroseanhydrid.

Richter, K.; Müller, H. (Maizena GmbH)

*German Federal Republic Patent Application* 2 144 406 (1973) [De]

Crystallized  $\alpha$ -dextrose anhydride is produced by concentrating a syrup containing  $\geq 93\%$  D-glucose (based on DM) and approx. 80-90% DM, and crystallizing it isothermically or according to a temp. programme at approx. 55-75°C to crystal size approx. 0.3-1.0 mm. Crystallization is carried out by adding 2-25 wt.% seed crystals of size approx. 0.02-0.10 mm, obtained from a syrup containing  $\geq 93\%$  glucose (based on DM) at approx. 55-75°C and under isothermic conditions, and/or 10-90% of massecuite from a preceding crystallization operation. The massecuite anhydride crystals are rinsed at approx. 55-75°C. The use of a purer syrup provides less fragile, easier-to-handle crystals. W&Co

7

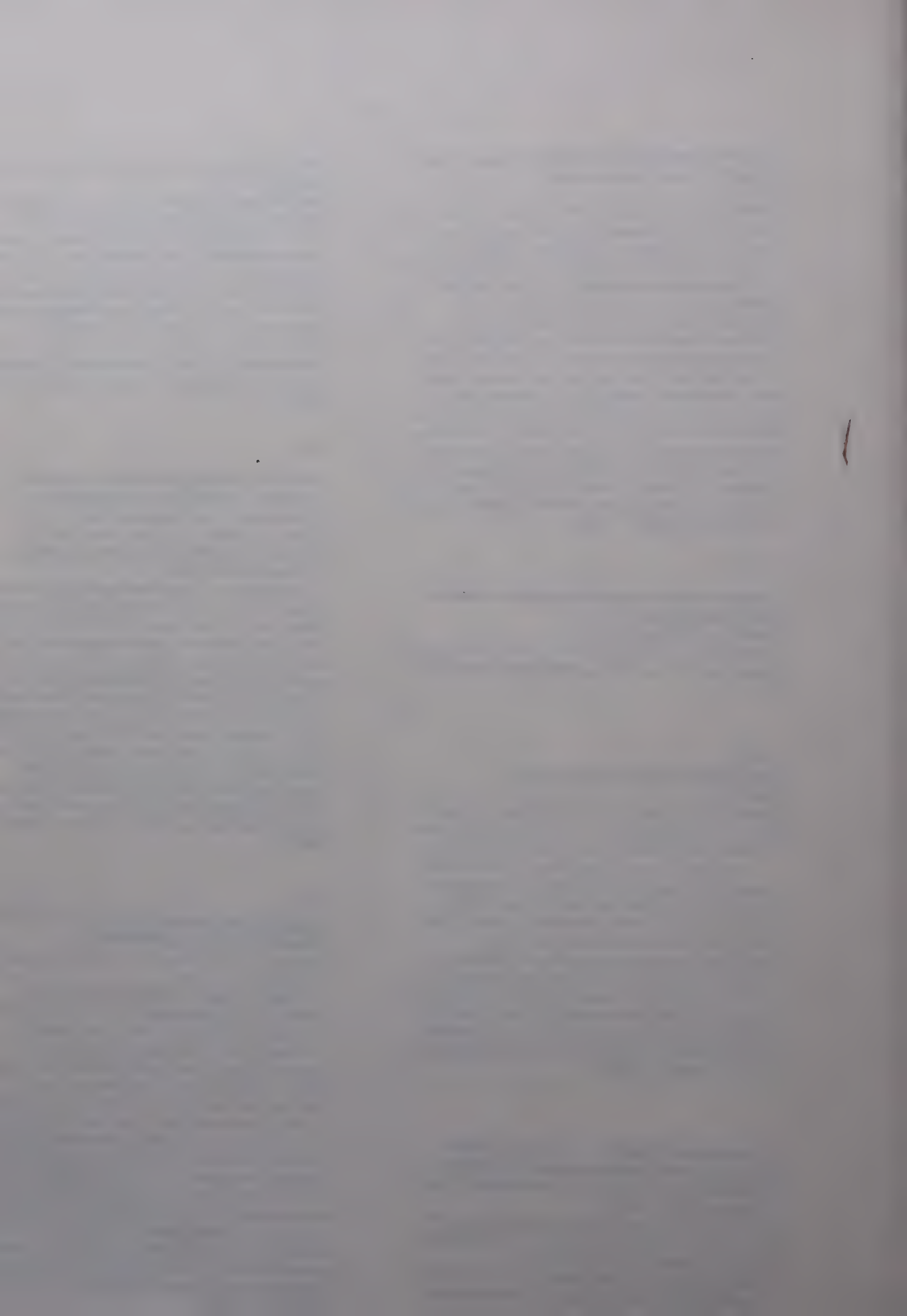
**[Application of glucose syrup instead of crystal glucose in riboflavin manufacture.]**

Grigorev, V. S.; Chuvashova, K. K.; Shchegolev, V. V.; Pankratov, A. Ya.

*Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya* No. 2, 63-64 (1973) [3 ref. Ru] [Voronezhskii Tekh. Inst., USSR]

Products with high sugar content may be obtained directly from starchy raw material using enzymes and eliminating the phase of starch isolation and purification. Surface culture of the mould *Rhizopus delemar* B was used to provide the source of glucosyl- $\alpha$ -amylase in cornflour hydrolysis. The depth of starch hydrolysis reached 98.45% of reducing compounds at 96.87% of glucose. The effect of various concn. of glucose syrup in the fermentation mixture on the synthesis of riboflavin using *Eremothecium ashbyi* as enzyme producer was studied. The most intensive riboflavin synthesis occurred when 1.0 to 2.0% of reducing compounds were present in the growth medium (704-820  $\mu\text{g}$  B<sub>2</sub> in 1 ml). STI





## 8

**Starch as a source of sweeteners. The actual situation in the United States of America.**

Whistler, R. L.

*Stärke* 25 (12) 424-426 (1973) [En, de, fr] [Dept. of Biochem., Purdue Univ., Lafayette, Indiana 47907, USA]

New developments in the commercial transformation of starch to sugar by low cost enzymatic reactions are discussed. An economic process has been developed to hydrolyse starch slurry to D-glucose with glucoamylase, followed by conversion of glucose to a mixture of approx. equal parts of glucose and fructose with isomerase. A 50:50 mixture is 1.2 times as sweet as sucrose. Apart from isomerase-converted corn syrups, other sugars derived from starch such as corn syrups and sugars, crystalline dextrose, maltose, maltotriose and maltitol are important sweeteners. Maltose is a good food for yeasts, maltitol can be used in products requiring a non-reducing sweetener, both maltose and maltitol are more stable than sucrose in acid foods. Corn and sorghum can be grown in sugar cane locations to produce a crop every 6 months (vs. 18 months for sugar cane), while producing at least as much sugar as cane besides other nutrients. RM

## 9

**[Application of enzymic glucose determination in cereal and starch analysis.]** Anwendung der enzymatischen Glucosebestimmung in der Getreide- und Stärkeanalytik.

Meuser, -.

*Gordian* 73 (11) 441 (1973) [De]

Determination of glucose, starch and starch fragments by enzymic methods is discussed. Comparison of the Beckmann glucose analyser (based on O<sub>2</sub> consumption during enzymic oxidation) with results obtained by hexokinase + glucose-6-phosphate dehydrogenase gave coeff. of variation <1%, max. variation within each method <3%. Composition of bakery products, glucose syrup and dietary products can be determined with amyloglucosidase which converts 95% of native starch to glucose. Examples of application include determination of higher and lower carbohydrate polymers in various types of bread, determination of rate of hydrolysis of lower polymers in the stomach, and determination of isomers in mutarotating glucose solutions with the glucose analyser + recording polarimeter. RM

## 10

**[Catabolic inhibition in yeast and industrial consequences.]**

Ramos-Jeunehomme, C.; Haboucha, J.; Devreux, A.; Masschelein, C. A.

*Proceedings, European Brewery Convention 14th*

Congress, 111-124 (1973/publ. 1974) [12 ref. Fr, en, de] [Service des Fermentations, Centre d'Enseignement et de Recherches des Ind. Alimentaires et Chimiques (CERIA), Brussels 1070, Belgium]

Brewery yeasts are distinguished by their specific response to the glucose effect. This response can be utilized for characterization. Investigations were made of the glucose inhibition of the synthesis and activity of maltozymase. For repression of maltozymase by glucose, yeast strains can be classified into 3 groups: strains where maltozymase is insensitive to glucose (*Saccharomyces carlsbergensis* 338); strains where maltozymase is repressed by glucose (*Sacc. cerevisiae* 101-106 and 173); and strains where maltozymase is inhibited by glucose (*Sacc. cerevisiae* 123 and nearly all *Sacc. carlsbergensis* examined). Industrial consequences arising from the response of the brewery yeasts to the glucose effect are covered. For inhibited yeast fermented on a medium which corresponds to 30% sugar and 70% malt, fermentation is considerably slowed down and can even cease at the beginning of maltose utilization. A similar phenomenon is not observed when "insensitive" yeast is used. AS

## 11

**[Production of glucose syrup from cassava starch by the 2-stage enzyme method.]**

Park, Y. K.; Papini, R. S.

*Coletanea do Instituto de Tecnologia de Alimentos* 3, 65-74 (1969/1970) [14 ref. Pt, en]

Amyloglucosidase was produced from *Aspergillus niger* NRRL 3122 and *Asp. awamori* NRRL 3112, which produce high amyloglucosidase and low transglucosidase. These enzymes were used to produce glucose syrup from cassava starch. Studies were made on the effect of varying concn. of thermostable  $\alpha$ -amylase and amyloglucosidase, temp. for saccharification of the liquefied starch, saccharification and holding time. The processing conditions for the liquefying and saccharification stages, needed for the production of high dextrose equivalent glucose syrup from cassava starch, are given in detail. [From En summ.] HBR

## 12

**Gas-liquid chromatographic determination of monosaccharides and glycerol in aged distilled spirits.**

Black, R. A.; Andreasen, A. A.

*Journal of the Association of Official Analytical Chemists* 57 (1) 111-117 (1974) [30 ref. En] [Joseph E. Seagram and Sons Inc., Box 240, Louisville, Kentucky 40201, USA]

GLC was utilized for the analysis of monosaccharides and glycerol in distilled spirits aged in new, charred white oak cooperage. Arabinose, xylose, fructose, glucose, galactose, and rhamnose were identified. Traces of fucose and mannose were indicated. Total concn. of sugars





increased from 16 to 37 g/100 l. at 100° proof and glycerol from 0.83 to 2.42 g/100 l. at 100° proof during ageing from 1 through 12 yr. Compounds were identified by a comparison of GLC chromatograms of trimethylsilyl (TMS) ether derivatives, alditol acetates and trifluoroacetates, and TMS-aldono-1,4-lactones. Sugars and glycerol were quantitated as TMS ether derivatives with 3% JXR organic phase on Gas-Chrom Q with an accuracy assessed at  $\pm 2-3\%$ . AS

### 13

**Monosaccharides in roasted and instant coffees.**  
Kröplien, U.

*Journal of Agricultural and Food Chemistry* 22 (1) 110-116 (1974) [26 ref. En] [Coca-Cola GmbH, Essen, Federal Republic of Germany]

Monosaccharides of roasted and instant coffee were analysed. A 1-step procedure for quantitative isolation of monosaccharides from coffees was developed. The sugars were quantified by thin-layer densitometry of their coloured reaction products with 4-aminobenzoic acid. Roasted coffee extracts contained glucose (0-0.9%), fructose (0-0.9%), arabinose (0-0.1%), and sometimes a trace of galactose. Contents were low in dark and high in light roasts. Instant coffees contained arabinose (0.4-2.5%), galactose (0.2-0.9%), mannose (0.1-1.0%), glucose (0-0.3%), fructose (0-0.5%), and traces of ribose and xylose. Laboratory extraction of roasted coffees at temp. up to 200° proved that arabinose, galactose, and mannose were formed by hydrolysis of polysaccharides. The relative composition of the monose fraction is likely to reflect the hydrolysis conditions in the manufacture of instant coffees. AS

### 14

**[Future prospects for development in the glucose industry.]**

Rotaru, N.

*Industria Alimentara* 23 (8) 431-434 (1972) [25 ref. Ro, en, fr, de, ru] [Inst. de Cercetari si Proiectari Alimentare, Bucharest, Romania]

Developmental prospects of the glucose industry are reviewed with particular reference to batch hydrolysis and syrup purification; continuous hydrolysis; enzymic and mixed hydrolysis; direct hydrolysis of cereals; and direct production of glucose from cereal concentrates. New lines, such as sorbitol production, are considered. SKK

### 15

**Bound water capacity of corn starch and its derivatives by NMR.**

Mousseri, J.; Steinberg, M. P.; Nelson, A. I.; Wei, L. S.

*Journal of Food Science* 39 (1) 114-116 (1974) [10 ref. En] [Dept. of Food Sci., Univ. of Illinois, Urbana, 61801, USA]

Bound water capacity (BWC) of corn starch, waxy maize starch, pregelatinized corn starch, hydrophilic starch, corn syrup, maltose and dextrose was determined by Wide-Line NMR. Corn starch and its hydrolytic products had the same BWC of 24% on a wet basis. Pregelatinized starch had a BWC of 24.3% while waxy maize starch and hydrophilic starch had a BWC of 28.1 and 26.6%, respectively. The usual straight line relation at high moisture obtained with starch and other macromolecules was not obtained with the corn syrups and maltose. Instead, a curvilinear relation was obtained. Replotting the data on a DM basis showed that addition of 1 g free water caused each dry sugar to lose 0.0312 g bound water. In investigating the NMR signal obtained from corn starch, at a moisture content near the BWC, it was found that a longer period of time was required to achieve equilibrium than at lower or higher moisture contents. IFT

### 16

**[Glucose syrup, glucose and fructose as alternative sweetening agents in ice cream.]**

Steinsholt, K.

*Meieriposten* 63 (7) 136-141; (8) 169-176; (9) 195-198; (10) 228-231 (1974) [No]

In a factorial experiment with 64 ice cream mixes (produced from whole milk, butter and dried skim-milk, and containing 11% milk SNF, 10% milk fat and 0.6% stabilizer and emulsifier),  $\leq 30\%$  (or in a 2nd experiment  $\leq 75\%$ ) of the sucrose content of 13% was replaced by dextrose, fructose or a glucose syrup containing 5% dextrose, 8% maltose, 11% trisaccharides, 8% tetrasaccharides and 68% higher saccharides. Sucrose was added to give a total sweetness corresponding to 13% sucrose. After pasteurization, homogenization and freezing in a Carpijani soft-ice freezer, the samples were stored for 1 month at  $-21^{\circ}\text{C}$  and then assessed organoleptically and analysed for viscosity, hardness, TS, density, meltdown, optical density etc. General conclusions were that replacement of 30% of the sucrose with the glucose syrup (or with dextrose, in the case of products consumed direct from the cabinet at low temp.) had a beneficial effect on ice cream quality, but replacement with fructose had apparently a negative effect. ADL





## 17

**Composition of the grist.**

Bradee, L. H.

*Technical Quarterly, Master Brewers Association of America* 11 (1) 57-62 (1974) [En, es] [Jos. Schlitz Brewing Co., Milwaukee, Wisconsin, USA]

The nature of the various adjuncts which can be used as a portion of the grist in mashing or added to the brew kettle is considered with special reference to brewers' grits (made from corn, rice or sorghum), brewers' flakes (made by moistening, cooking, rolling and drying the grits), wheat flour, corn syrup, sacrose and invert sugar. Advantages and disadvantages of their use and their effect on the composition of the wort are discussed. AA

## 18

**[Composition characteristics of maltose syrup obtained by enzyme saccharification.]**

Trigubov, N. N.; Pomicheva, E. V.; Rodzevich, V. I.; Dobrolinskaya, G. M.

*Pribludnaya Biokhimiya i Mikrobiologiya* 9 (5) 797-799 (1973) [6 ref. Ru, en] [Moscow Tech. Inst. of Food Ind., USSR]

25% aqueous suspensions of maize flour were liquefied using amylosubtilin G-10-Kh preparation and saccharified using (i) G-10-Kh strain 3-9-15 amylolysin preparation, or (ii) P-10-Kh strain I-476 amylolysin preparation in comparison with (iii) malt. Saccharification at 55°C was virtually completed in 1.5 h. The carbohydrate composition of syrups obtained using (i)-(iii) respectively was: reducing substances, 71.5, 71.0 and 70.5%; glucose 11.0, 12.0 and 14.5%; maltose, 49.6, 44.0 and 40.1% and total dextrans, 39.0, 44.6 and 46.1%. With (i), the final N content in syrup DM was 1.3% vs.  $\leq 2\%$  and  $> 3\%$  with (ii) and (iii) respectively. It is considered that maltose syrup obtained using (i) is suitable for infant feeding. [See also FSTA (1973) 5 4L318.] SKK

## 19

**[Production of glucose syrup from cassava starch by enzyme-enzyme method.]**

Park, Y. K.; Papini, R. S.

*Revista Brasileira de Tecnologia* 1 (1) 13-16 (1970) [17 ref. Pt, en] [Inst. de Tecnologia de Alimentos, Caixa Postal 655, Campinas, SP, Brazil]

Amyloglucosidase was produced from *Aspergillus niger* NRRL 3122 and *A. awamori* NRRL 3112, which produce high amyloglucosidase and low transglucosidase. These enzymes were used to produce glucose syrup from cassava starch. Studies were made on the effect of varying concn. of thermostable  $\alpha$ -amylase and amyloglucosidase, temp. for saccharification of the liquefied starch, and holding time for saccharification. For the production of high dextrose equivalent glucose syrup from cassava starch, 30% (w/w) cassava starch slurry and bacterial  $\alpha$ -amylase of  $\geq 1500$  SKB

units/500 g of starch were mixed together. They were gradually heated at the rate of 1.5°C/min, pH adjusted to 6.0, with stirring at 85°C, permitting liquefaction for 30 min, then cooling to 60°C, and final pH adjusted to 4.0. After the liquefying process  $\geq 70$  units (AU) amyloglucosidase/500 g of starch were added, followed by holding for 72 h at 60°C. [From En summ.] VJG

## 20

**[6 years of trials on sugar cane varieties in the Loukkos valley.]**

Schmidt, G.; Hesse, F. W.; Tissot, R.

*Awamia* 39, 1-13 (1971) [3 ref. Fr, en, es, ar]

Five sugar cane varieties were compared from 1964 to 1970 in the Loukkos valley near Larache. In spite of limited water supply results from the 2 best varieties were encouraging: CP44-101 gave a mean annual yield of 93 t cane and 13.6 t available sugar/ha, NC<sub>3</sub> 310 gave 76 t cane, 10.6 t available sugar. Other results for the 2 varieties were: % sucrose 15.2, 14.9; first juice purity 91.0, 89.7; glucose coeff. 2.03, 2.20; % fibre 17.4, 15.1; salt coeff. (% Pol: % ash) 24.4, 20.5; K<sup>+</sup> (m-equiv/100 g juice) 5.4, 7.0; Na<sup>+</sup> 1.01, 0.84. Sampling of ratoons before harvesting in 1966 and 1967 showed acceptable saccharose contents about 10 months after previous harvests, and 12.5 months for a virgin cane. RM

## 21

**[A modern new food industry enterprise: the starch and glucose factory at Tirgu Secuiesc.]**

Richter, E.

*Industria Alimentara* 24 (2) 76-77, 98, (1973)

[Ro, en, fr, de, ru] [Fabrica de Amidon si Glucoza, Tirgu Secuiesc, Rumania]

The starch and glucose factory established in 1970 in Tirgu Secuiesc is described, an operation flow sheet and some photographs of equipment being included. DM utilization amounts to 96% for maize and 92% for potatoes. Apart from dried starch and glucose syrup constituting the main products, dried gluten for food and feed purposes, protein coagulate for feed purposes as well as a conc. liquid by-product for the antibiotics industry are produced. SKK

## 22

**[Production of pure glucose via the double salt with sodium chloride.]**

Simionescu, I.

*Industria Alimentara* 25 (1) 20-21, 37 (1974)

[Ro, en, fr, de, ru] [Inst. de Cercetari si Proiectari Alimentare, Bucharest, Rumania]

The process patented in Rumania by T. D. Ionescu, I. Simionescu et al. for production of pure glucose from starch hydrolysates by purification through an adduct of 1 molecule NaCl and 2 molecules glucose is described in detail. Advantages and disadvantages of the method are discussed. SKK





## 23

**Fractionation of corn syrup.**

Jacin, H.

*Stärke* 26 (4) 118-122 (1974) [10 ref. En, de, fr] [Res. & Dev. Div. Life Savers Inc., Port Chester, New York 10573, USA]

Corn syrup was fractionated by liquid chromatography on a cellulose support and ethanol-water gradient elution. Carbohydrates were determined quantitatively by the phenol  $H_2SO_4$  method [Analytical Chemistry (1956) 28 350]. A normal 43 dextrose equivalent syrup gave 20 peaks and a materials balance of 92.3%, with 19.8% glucose, 14.0 maltose, 13.1 maltotriose and 9.1 maltotetraose. A high maltose corn syrup gave 18 peaks and a 99.7% materials balance, with 6.8% glucose, 31.7 maltose, 14.3 maltotriose and 12.6 maltotetraose. These results agreed well with GLC analysis and manufacturers' specifications. RM

## 24

**High fructose syrup cuts sweetener costs by 15%.**

Anon.

*Food Processing* 35 (5) 38 (1974) [En]

Sweetener costs in the 15-flavour line of carbonated beverages produced by Popular Club Beverages, Baltimore, Maryland, have been reduced by 15% by the use of a special high-fructose corn syrup. Flavour and colour quality of the beverages were not affected and the shelf life of the finished beverages formulated with the syrup was found to be as good for the syrup/sugar beverages as for all-sugar sweetened beverages. AA

## 25

[Density and viscosity of Equeur base mixtures in the temp. range 0-50°C.] Dichte- und Viskositätswerte einiger Likör-Basisgemische im Temperaturbereich zwischen 0 und 50°C.

Wasmund, R.; Apelt, J.; Buchmüller, J.

*Branntweinwirtschaft* 114 (10) 225-228 (1974) [6 ref. De]

The effects of temp. and composition on the sp. gr., dynamic viscosity and kinematic viscosity of liqueur base mixtures were evaluated in a series of studies on 4 model solutions (25-40% sucrose, 5-20% glucose, 25% ethanol and 30% water). The experiments covered the temp. range 0-50°C. Tables and graphs of results are given. Results showed that sp. gr., dynamic viscosity and kinematic viscosity decreased with increasing temp. Sp. gr. increased and viscosity decreased with increasing sucrose content and decreasing glucose content. Comparison of experimental and calculated values showed that experimental error varied from 0.3 to 2.26% (mean error was 1.15%). AJDW

## 26

[The flow properties of single phase liqueur base mixtures.] Das Fließverhalten einphasiger Likör-

Basisgemische.

Wasmund, R.; Apelt, J.; Buchmüller, J.

*Branntweinwirtschaft* 114 (13) 283-286 (1974) [1 ref. De]

The effects of temp. (0-50°C) and composition (25-40% sucrose, 5-20% glucose, 25% ethanol and 30% water) on the flow properties of liqueur bases were determined; shear strain was measured with a rotary viscometer at various shear rates. The results are presented graphically. Results showed that the liqueur bases all exhibited Newtonian flow properties. AJDW

## 27

**[Heat and mass transfer during drying.]**

Bimbenet, J. J.

*Scienza e Tecnologia degli Alimenti* 2 (4) 215-222 (1972) [It, en] [Ecole National Supérieure des Ind. Agricoles et Alimentaires, CERDIA, 91-Massy, France]

A model is described and the necessary mathematic formulae are given for expressing the processes of heat and mass transfer during hot-air drying. The calculations were confirmed by experiments with glucose and alanine solutions. Analysis of the results showed that one of the major difficulties encountered during the drying of biological products was the presence of dissolved matter in solids. HBr

## 28

**[γ-Radiolysis of carbohydrates in aqueous solution. Radiolysis products from D-glucose and D-fructose.]**

Kawakishi, S.; Kito, Y.; Namiki, M.

*Food Irradiation [Shokuhin-Shosha]* 8 (1) 88-94 (1973) [6 ref. Ja, en] [Dept. of Food Sci. and Tech., Nagoya Univ., Japan]

## 29

**Experiences with the DDS Kroyer direct hydrolysis process. [Lecture]**

Bos, C.; Norr, N. J.

*Stärke* 26 (6) 181-185 (1974) [1 ref. En, de, fr] [DDS Kroyer A/S, Prags Boulevard 47, DK-2300 Copenhagen S, Denmark]

The DDS-Kroyer direct hydrolysis process for producing dextrose monohydrate and glucose syrup directly from degermed maize grits by bacterial α-amylase is described. Commercial operation during 3 yr produced the following alterations to the original process: protein and fibre filtration before saccharification (hydrolysates of the DL 28-30 stage) improved colour and filtration of hydrolysate; heating grits slurry to 150°C before liquefaction prevented fermentation; blending suitable quantities of 28-30 DL and 38 DL hydrolysates to produce a syrup of 95% dextrose; degerming DL 38-40 stage hydrolysates to produce a syrup of 97% dextrose achieved by degerming before liquefaction; improve filtration of syrup by degerming.











M.; Burdukova, R. S.

*Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya* No. 5, 124-125 (1973) [3 ref. Ru] [Kievskii Tekhnologicheskii Inst. Pishchevoi Promyshlennosti, Kiev, USSR]

With the equipment used in the study referred to in FSTA (1974) 6 7L420, effects of temp. in the 25°-70°C range and concn. in the 0-70 wt. % range on the interdiffusion coeff. (IC) of glucose solutions were studied. Over the whole range of concn., the relationship between temp. and IC proved exponential; while the relationship between concn. and IC proved non-linear over the whole temp. range. With increase in glucose concn. >40%, the hydration structure changed into association structure. These findings are similar to those for a sucrose/water system [FSTA (1973) 5 3L161]. SKK

### 35

[Method for enthalpy determination of the hydrolysis reaction of carbohydrates of the glucose homologous series.]

Gorokhov, G. I.; Sryvalin, I. T.

*Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya* No. 6, 43-45 (1973) [2 ref. Ru] [Krasnodarskii Politekhnikeskii Inst., Krasnodar, USSR]

Calculated enthalpy values for glucose homologues (polymerization degree, 2, 3, 4, 5, 6, 7, 10, 27 and 100) are tabulated. SKK

### 36

Confectionery ingredients. Specific rotatory power. III.

Cakebread, S. H.

*Confectionery Production* 40 (6) 254-256 (1974) [7 ref. En] [Knetchel Lab. Ltd., Skokie, Illinois, USA]

Effects of non-sugars (acids, salts, alkalies), on specific rotatory power (SRP) and the SRP of mixed sugars (sucrose/invert sugar, sucrose/dextrose) and glucose syrups are discussed. [See FSTA (1974) 6 8L599 for part II.] VJG

### 37

[Glucose isomerase. New uses for the starch and food industries.] Glucoseisomerase. Neue

Möglichkeiten für die Stärke- und Lebensmittelindustrie. [Lecture]

Geyer, H. U.

*Stärke* 26 (7) 225-232 (1974) [45 ref. De, en, fr] [Chemie GmbH & Co. KG, Biochemisches Werk, 3070 Nienburg/Weser, Grosse Drakenburger Strasse, Miles Kali, Federal Republic of Germany]

A glucose isomerase producing a 50:50 equilibrium mixture of glucose + fructose from D-glucose was obtained from *Streptomyces albus* YT-5 (ATCC 21 132). It is active under manufacturing conditions, i.e. at temp. up to 80°C, pH <6.5 (which prevents psicose formation) and has double the

activity of the *Arthrobacter* glucose isomerase at pH <6.2. The degree of isomerization (DI) obtained is max. of 30-50% glucose and increases with temp., enzyme concn. and presence of  $\text{Co}^{2+}$  and  $\text{Mg}^{2+}$  ions. Effects of processing conditions on colour formation and methods of avoiding it are discussed. The enzyme is specific for D-glucose.

Immobilization of the enzyme in cells of *S. albus* allowed 12 times re-use, with constant DI during the first 8 cycles. A combined integrated process with  $\alpha$ -amylase and glucoamylase can be used to produce carbohydrates of 100% relative sweetness from wheat, potatoes, maize, etc. RM





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FAB 20

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H. BROOKES

ASSISTANT EDITOR





## 1

**Rheological properties of food products and their use in the design of flow systems.**

Boger, D. V.; Tiu, C.

*Food Technology in Australia* 26 (8) 325-327, 331-332, 334-335 (1974) [7 ref. En] [Dept. of Chem. Eng., Monash Univ., Clayton, Victoria 3168, Australia]

The fundamental flow property measurements required for the characterization of a non-Newtonian food product are reviewed. Representative flow property data obtained with a capillary, cone and plate and concentric cylinder rheometer for corn syrup, molasses, mayonnaise and a cooking oil are presented. The wide range of flow property behaviour demonstrated by these materials and the agreement of results from various instruments are discussed. Examples are given to show how the flow property measurements for a food product are used in the design of a flow system. AS

## 2

**[Browning mechanism of tomato products. IV. Substances showing absorption in the ultraviolet region.]**

Adachi, Y.; Ukai, N.; Kosuge, S.

*Journal of Food Science and Technology [Nihon Shokuhin Kogyo Gakkai-shi]* 19 (5) 189-193 (1972) [11 ref. Ja, en] [Kagome Co., Naka-ku, Nagoya, Japan]

When tomato serum was heated in boiling water with aeration for 3-11 h, it gradually turned brown and showed higher absorption in the UV region (at 264-270 nm in the serum itself and 285-287 nm in its ether extract), which was due to an increase in 5-hydroxymethylfurfural (5-HMF), which could be determined by polarography and colorimetry with resorcinol. Addition of sugars enhanced the browning of tomato serum; the effect was greatest with xylose, followed by fructose, galactose, sucrose, glucose, and maltose. When the concn. of tomato serum was increased from a refractive index of 5.5 (normal) to 8.3 and 11, the relative browning by heating for 15 h with fructose was 1.0, 1.9 and 3.3, and the 5-HMF concn. (mg/100 g) was 27, 38 and 51. SKA

## 3

**Glutamic acid synthesis via immobilized enzymes: a technical-economic analysis.**

Brownstein, A. M.; Vieth, W. R.; Constantinides, A.

*Abstracts of Papers, American Chemical Society* 168, INDE 11 (1974) [En] [Chem. Systems Inc., 747 Third Avenue, New York, New York 10017, USA]

A technical-economic analysis has been made of the use of immobilized whole cells (*Corynebacterium glutamicum*) in the production of monosodium glutamate (MSG) from dextrose.

Although application of immobilized cells offers a potential saving of 40% in fixed capital for MSG manufacture, this is offset by its lower catalyst life. A substantial, potential economic advantage accrues to immobilized cells if their use can be improved 3-fold or greater. A detailed description of process economics and design is presented. AS

## 4

**[Immobilized enzymes.] Immobilisierte Enzyme.** Manecke, G.

*Chimia* 28 (9) 467-474 (1974) [41 ref. De, en] [Inst. für Organische Chem., Freie Univ., Berlin Thielallee 63-67, D-1 Berlin (West) 33]

The preparation, properties and uses of immobilized enzymes are reviewed. The binding of enzymes to supports may result in changed pH optima,  $K_m$  values and heat stability. Food uses of immobilized enzymes include pepsin for continuous cheese curd production from skim-milk, pectinase for clarification of fruit juice, wine and beer, glucoamylase for automatic starch saccharification, and hexose isomerase for conversion of glucose to fructose. RM

## 5

**[Immobilization of glucose isomerase by entrapping in cross-linked polyacrylamide gel.]**

Kasumi, T.; Kawashima, K.; Tsumura, N.

*Journal of Fermentation Technology [Hakko Kogaku Zasshi]* 52 (5) 321-327 (1974) [23 ref. Ja] [Nat. Food Res. Inst., Min. of Agric. & Forestry, Shiohama-1, Koto-ku, Tokyo, Japan]

Glucose isomerase from *Streptomyces phaeochromogenus* strain SK was entrapped in cross-linked polyacrylamide gel polymerized by  $\gamma$ -ray irradiation or by ammonium persulphate with dimethylaminopropionitrile catalyst. The fixed enzyme prepared with 20% acrylamide solution and irradiation dose of 40 krad retained 50-60% activity with no significant changes in optimum temp. or pH of reaction and increased heat stability. Continuous isomerization of glucose to fructose was studied. HK

## 6

**Confectionery ingredients. Specific ingredients of carbohydrate solution. II.**

Cakebread, S. H.

*Confectionery Production* 40 (9) 392-395 (1974) [2 ref. En] [Knetchel Lab. Ltd., Skokie, Illinois, USA]

Effects of concn., and degree and type of conversion on the sp. gr. of glucose syrup are discussed. VJG



## 7

**Sweetening ingredients in the canning industry.**

Walter, R. D.

*Food Production/Management* 97 (3) 10, 12-13 (1974) [En] [CPC Int. Inc., International Plaza, Englewood Cliffs, New Jersey, USA]

The characteristics of sweeteners used in canned foods are discussed with special reference to:

sucrose; invert sugars; dextrose; and corn syrup.

AA

## 8

**[The effect of mutarotation on the crystallization rate of hydrated glucose.]**

Arkhipovich, M. O.; Petrushev'skii, V. V.

*Kharchova Promislovist' (Respublikans'kii Mizhvidomchii Naukovo-tekhnichnii Zbirnik)* No. 13, 84-85 (1971) [4 ref. Uk]

The effect of temp. and pH of the environment on the velocity constant of glucose mutarotation on was studied and this relationship was expressed mathematically. The crystallization velocity constant (determined in the same dimensions (mol/min) as the velocity constant of mutarotation) was, for different quality products and under different conditions,  $2 \times 10^6$ - $4 \times 10^6$  times smaller than the mutarotation velocity constant. It is concluded that the mutarotation does not retard glucose crystallization. STI

## 9

**[Comparison of two technological schemes of glucose hydrate production.]**

Petrushevskii, V. V.

*Sakharnaya Promyshlennost'* 48 (4) 74-75 (1974) [Ru] [VNIIC, USSR]

2 methods of glucose production by acid hydrolysis of starch are discussed. Both are 2-product methods in which either (i) the green syrup of the 1st product is subjected to secondary hydrolysis, or (ii) following (i) the crude glucose crystals receive additional washing. (i) results in poorer quality of the 2nd products due to retention of some non-sugars. In (ii) the crystals of the 1st product are washed before addition to the syrup of the 1st product and non-sugars trapped on the crystal surfaces do not remain in the 1st product syrup. (ii) gives 11.15% higher yield of glucose with a better colour and is recommended. STI

## 10

**Solid corn syrup product.**

Glabé, E. F.; Anderson, P. W.; Laftsidis, S. (Food Technology Inc.)

*United States Patent* 3 833 413 (1974) [En]

A solidified product from high fructose corn syrup is prepared by a process in which a high

protein, high water soluble soy protein is incorporated with a high fructose corn syrup to form a slurry prior to dehydration. The process enhances the crispness and rapidity of crystalline formation when the slurry is subsequently dehydrated as a thin film on a heated surface. IFT

## 11

**[Determination of glucose and oligosaccharides in maltose syrup.]**

Tregubov, N. N.; Fomicheva, E. V.

*Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya* No. 2, 173-174 (1974) [5 ref. Ru] [Moskovskii Ordena Trudovogo Krasnogo Znameni Tekh. Inst. Pishchevoi Promyshlennosti, USSR]

The composition of syrups prepared from corn flour was studied, using separation by column chromatography and titration with thiosulphate. Maltose syrup contained glucose, maltose, maltotriose and maltotetraose; malt enriched the syrup mostly with maltotriose. The chromatograms confirmed the absence of transferase activity in the enzyme preparations used since hydrolysates contained no isomaltose. STI

## 12

**Factors affecting the catalytic hydrogenation of D-glucose. I. Effect of type of catalyst and concentrations of both glucose and catalyst.**

Abdel Akher, M.; Ghali, J.; Raouf, M. S.; Roushdi, M.

*Stärke* 26 (9) 307-312 (1974) [20 ref. En, de, fr] [Fac. of Agric., Univ., Cairo, Egypt]

The effects of 5 different types of catalyst (4 preparations of Raney nickel and 1 of copper chromite) and of the concn. of catalyst and glucose on the rate of hydrogenation of glucose to sorbitol were studied. At 130°C and 60 atm., a French Raney nickel (Prolabo) was the most active, producing 99.49% hydrogenation in 5 h, 99.99 in 6 h. No hydrogenation took place with copper chromite. Catalyst (Prolabo) concn. of 4, 8 and 12 g/100 g glucose in 250 ml produced 72.59, 82.76 and 87.67% hydrogenation in 5 h at 100°C, 83.34, 99.04 and 99.49% at 130°C. During the first 3 h the reaction appeared to be of the first order. The rate of hydrogenation was not significantly affected by increasing glucose concn. from 20 to 52%. [See also following abstr.] RM

## 13

**Factors affecting the catalytic hydrogenation of D-glucose. II. Effect of pressure and temperature.**

Akher, M. A.; Ghali, J.; Raouf, M. S.; Roushdi, M. *Stärke* 26 (10) 352-355 (1974) [8 ref. En, de, fr] [Fac. of Agric., Cairo Univ., Egypt]

[See preceding abstr.] The effects of 20, 40, 60 and 80 atm constant pressure of H<sub>2</sub> and 20 atm of N<sub>2</sub> followed by H<sub>2</sub> to 60 atm, at 130°C, and of 100°, 130° and 170°C at 60 atm. H<sub>2</sub> pressure on catalytic hydrogenation of glucose were



investigated. The % hydrogenation of glucose to sorbitol after 3 h at 20, 40, 60 and 80 atm  $H_2$  were 49.7, 85.4, 89.5 and 99.2 respectively and no other products were formed. The reaction was of first order and pseudo-second order. With a mixture of  $N_2$  and  $H_2$ , the hydrogenation rate was the same for the same total pressure. Increasing the temp. from 100° to 170°C reduced the time required by 50% without formation of isomeric products. RM

## 14

[Inhibition by tryptophan of colour development in colorimetric determination of glucose by the glucose oxidase-peroxidase method.]

Fuwa, H.; Tanaka, M.; Nishio, H.

*Journal of the Japanese Society of Starch Science*

[*Denpun Kogyo Gakkaishi*] 20 (4) 172-176

(1973) [12 ref. Ja, en] [Dept. of Food and Nutr., Osaka City Univ., Sumiyoshi-ku, Osaka, Japan]

Colour development, depending on reduction of o-dianisidine, in colorimetric determination of glucose by the glucose oxidase-peroxidase method was inhibited by L-tryptophan or DL-tryptophan in concn. >0.25-0.5 mM. Glucose can be determined chemically by the anthrone-sulphuric acid method of Hansen et al. [American Journal of Physiology (1960) 198, 850] in the presence of 10-20 mM L-tryptophan. AS

## 15

[Improved procedure for glucose manufacture.]

Brzyski, W.; Remiszewski, M.

*Przemysł Spożywczy* 28 (3) 109-111 (1974) [13 ref. Pl, ru, en, fr, de] [Lab. Przemysłu Ziemiaczanego, Poznań, Poland]

A new acid/enzyme procedure of glucose manufacture developed in the authors' laboratory was introduced in 1972 in the 'Łomża' potato Industry factory in Poland to replace the old acid hydrolysis procedure. The new process involves acid liquefaction of potato starch, saccharification by an amyloglucosidase preparation, refining and concentration of the juice, crystallization and centrifugal separation of crystals. The flow sheet of the process and technical details are presented. The crystalline glucose produced is said to contain less Cu and be of lighter colour than glucose made by the acid process. The compositions of the mother liquors (used for alcohol manufacture) from the new and old process respectively were: density, 62.3° and 65.8° Brix; reducing substances in DM, 71.0 and 69.9%; maltose in DM, 24.6 and 31.1%; glucose in DM, 55.0 and 53.3%; chlorides in DM, 1.5 and 6.6%; copper, 2.5 and 22.5 mg/kg; and pH, 4.3 and 3.9. The new procedure resulted in a saving of approx. zł 4600/t, simplification of the process and reduction in corrosion of equipment. SKK

## 16

[Direct hydrolysis of starchy raw materials.]

Grzeskowiak, M.; Remiszewski, M.

*Przemysł Spożywczy* 28 (2) 62-65 (1974) [6 ref. Pl, ru, en, fr, de]

Methods of direct enzymic hydrolysis of starchy raw materials (maize in particular) are reviewed and flow sheets of maize preparation for hydrolysis and maize syrup production as well as a components' balance diagram are presented. SKK

## 17

The influence of wort glucose level on the formation of aromatic higher alcohols.

Szlavko, C. M.

*Journal of the Institute of Brewing* 80 (6) 534-539 (1974) [5 ref. En] [Beverage Sci. Dept., Labatt Breweries of Canada Ltd., London, Ontario, Canada]

Increasing amounts of glucose either in solid form or in solution were added to all-malt worts, and to worts that contained maize as adjunct. Fermentations were then carried out using either ale or lager yeast. The resultant beers were analysed by gas chromatography for the aromatic higher alcohols tryptophol, tyrosol and phenylethanol; the amyl alcohols were also determined as typical representatives of the aliphatic higher alcohols. Increasing concn. of glucose in the wort resulted in either decreasing levels of tyrosol and phenylethanol (ale yeast) or increasing levels (lager yeast). Tryptophol demonstrated a different pattern both with ale and lager yeasts, by increasing in concn. up to a certain max. then decreasing. AS

## 18

Studies of stabilization of vegetable concentrates by controlled crystallization with glucose. [Conference proceedings]

Kwasniewski, R.; Kowalski, S.; Szkutnik, K.

*IV International Congress of Food Science and Technology* 5a, 50-52 (1974) [En] [Inst. of Fermentation Ind., 02-532, Warsaw, Poland]

A method was developed for stabilizing 60-70% solids content vegetable juice concentrates by 2-stage controlled crystallization with glucose. Final crystallization of the soft products at atm. pressure and 25°C produced free-flowing granules stable at 20°C without air-tight packaging, with very low hygroscopicity and high water solubility. RM

## 19

The flavourist as biochemist.

Wiener, C.

*Flavour Industry* 5 (9/10) 237-238, 242 (1974) [6 ref. En] [Polak's Frutal Works Inc., Middletown, New York, USA]

Studies on flavour formation in natural products, flavour development during food processing and biochemical rationalization (development of new flavours and flavour concepts) are considered. Flavours of heated 1:1 ratios of  $\alpha$ -amino acid-glucose mixtures are tabulated (aroma noted by the panel at 100°C and 180°C). VJG



## 20

**Factors affecting the catalytic hydrogenation of D-glucose. III. Effect of pH value and promoters.** Akher, M. A.; Raouf, M. S.; Ghali, J.; Roushdi, M. *Stärke* 26 (11) 383-385 (1974) [8 ref. En, de, fr] [Dept. of Food Tech., Fac. of Agric., Cairo Univ., Egypt]

Hydrogenation of glucose to sorbitol was carried out at pH 6.8-9.1 at 130°C and 60 atm. in NaOH, Ca(OH)<sub>2</sub>, Mg(OH)<sub>2</sub>, Ba(OH)<sub>2</sub>, CaCO<sub>3</sub>, MgCO<sub>3</sub> or BaCO<sub>3</sub> solution. The time required to complete hydrogenation was halved in alkaline solution. No product other than sorbitol was formed at pH 8; traces of mannitol were formed at pH 9.1. Hydrogenation at pH 6.8 was considerably accelerated by addition of some metals and salts in the following order: FeCl<sub>3</sub> < Cu < CaCl<sub>2</sub> < Fe < Mg < BaCl<sub>2</sub> < CaSO<sub>4</sub>. With CaSO<sub>4</sub> as promoter, the time for complete hydrogenation was halved. [See FSTA (1975) 7 3L285 for Part II.] RM

## 21

**Rapid detection of urea, ammonium sulphate and glucose used as adulterants in milk.** [Conference proceedings]

Mittal, S. B.; Roy, N. K.

*XIX International Dairy Congress* 1E, 472-473 (1974) [En] [Nat. Dairy Res. Inst., Karnal, India]

Adulteration of milk with 0.1% (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> or urea could be detected by the colour reaction with NaOH, hypochlorite and phenol; for urea, the test had to be applied to a protein-free filtrate of the milk. Using Barfoed's reagent and a phosphomolybdic acid reagent, addition of 0.05% glucose to milk could be detected; down to 0.01% could be detected in a protein-free filtrate of milk. JMD

## 22

**[Industrial applications of enzymes.]**

Marconi, W.

*Scienza e Tecnologia degli Alimenti* 4 (2) 71-80 (1974) [79 ref. It, en] [Lab. Processi Microbiol., Snaru Progetti, Monterotondo, Rome, Italy]

Method of isolation, purification and formulation and industrial applications of commercially used enzyme preparations are briefly reviewed. Different techniques of enzyme immobilization are described: physical entrapment, covalent binding to insoluble supports, adsorption on insoluble matrices. Catalysis by immobilized enzymes is discussed with respect to reaction kinetics and diffusion parameters. Process using enzymes entrapped in fibrous matrices are described, including starch saccharification, glucose isomerization and hydrolysis of lactose in milk (to overcome problems of lactose intolerance). RM

## 23

**[Dextrose composition and method of its manufacture.]** Traubenzuckermischung und Verfahren zu ihrer Herstellung. Wixforth, B. (Biolabor Walter Brachmann) *German Federal Republic Patent Application* 2 315 112 (1974) [De]

A dextrose composition suitable as a supplementary nutrient contains 0.3-1.5 mg, preferably 1 mg, fluorine/100 g dextrose added in the form of an edible mineral concentrate which may also contain Ca and P (as HPO<sub>4</sub>). The mineral concentrate may be a spa salt or an ash of animal or vegetable origin (particularly marine) fused with Na<sub>2</sub>CO<sub>3</sub>. W&Co

## 24

**Studies in the isomerization of D-glucose.** [Lecture] Scallet, B. L.; Shieh, K.; Ehrenthal, I.; Slapshak, L. *Stärke* 26 (12) 405-408 (1974) [20 ref. En, de, fr] [Corn Products Section, Central Res. Dept., Anheuser-Busch Inc., St. Louis, Missouri, 63118, USA]

A new patent D-glucose isomerase of high temp. stability was discovered in fungi of the genus *Actinoplanes*, especially *A. missouriensis*. The enzyme is intracellular and can be used as whole cells or isolated and purified. It isomerized 19.5 mg D-glucose or 9.5 mg D-xylose/ml in 20 min from 1.0M solution; was not affected by other sugars or the polyols ribitol and mannitol; was inhibited by galactitol, sorbitol and especially Xylitol (to 35% relative activity); was activated by Mg<sup>2+</sup> and Co ions; and was relatively stable at 90°C. Conversions of glucose to fructose of 51.0-53.6% were obtained at 70-90°C. Optimum pH is 7.0-7.5. Combination of the isomerase with bacterial α-amylase and gluco-amylase for production of fructose-containing syrups from starch is suggested. RM

## 25

**Continuous isomerization of glucose to fructose on a commercial basis.** [Lecture]

Schnyder, B. J.

*Stärke* 26 (12) 409-412 (1974) [9 ref. En, de, fr] [Clinton Corn Processing Co., Clinton, Iowa 52732, USA]

An efficient low-cost commercial process is described for continuous enzymic conversion of glucose to fructose by using immobilized glucose isomerase. In a multiple bed reactor system at bed depth 1-5 in, 20-80°C, pH 6-9, a 93% glucose (DM basis) liquor is isomerized to about 42% fructose. Under temp., pH- and substrate concn.-controlled commercial operating conditions enzyme half-lives of several hundred h are obtained. Activated C and ion exchange purification produce colourless ash-free syrup. Compared with a batch process, the continuous process has the following advantages: (i) lower enzyme use and glucose conversion cost, (ii) lower capital investment and labour costs, (iii) better process control, (iv) lower refining costs and improved product quality. RM



## 26

## [Glucose/fructose conversion.]

Japan, Agency of Industrial Science & Technology  
*Japanese Patent* 4 942 555 (1974) [Ja]

Process is described in which thermophilic glucose isomerase is used to convert glucose to fructose. IFT

## 27

## [Determination of glucose content of starch syrups using glucose oxidase.]

Janicki, J.; Czarnecki, Z.

*Przemysł Spożywczy* 28 (12) 534-535 (1974) [16 ref. Pl, ru, en, fr, de] [Inst. Tech. Żywności Pochodzenia Roslinnego AR, Poznań, Poland]

25 mg 3/GOD glucose oxidase and 8 mg 7/POD peroxidase, both from VEB Arzneimittelwerk, Dresden, German Democratic Republic, were dissolved in 100 ml tris buffer, and 1 ml 1% alcoholic solution of ortho-dianisidine was added directly before use. 10 ml of the enzyme solution were incubated with 1 ml sample for 35 min at 37°C and extinction was measured at 455 nm [nm] in comparison with that of a blank; glucose content was read from a standard curve. Before determination, the syrup was diluted to contain 50-200 µg glucose/ml. The method was found rapid and simple in execution and is considered more reliable than the generally used method of Steinhoff [*Zeitschrift für Spiritus-Industrie* (1953) 56, 64]. SKK

## 28

## Enzymes as industrial catalysts. [Lecture]

Konecny, J.

*Chimia* 29 (3) 95-102 (1975) [64 ref. En] [Pharma Forschung, CIBA-GEIGY AG, Basel, Switzerland]

This paper outlines the progress which has been made in extending the utility of enzymes as catalysts by developing efficient methods for their production and isolation and by immobilizing them on solid carriers. The properties of immobilized enzymes are discussed in relation to technological and economic requirements. Industrial processes utilizing enzymes, e.g. for starch hydrolysis, glucose isomerization or conversion of starch syrups, are briefly discussed. RM

## 29

## Production of crystallized glucose from poor glucose by the double salt method.

Hosaka, H.

*Journal of the Faculty of Fisheries and Animal Husbandry, Hiroshima University* 13 (1) 67-81 (1974) [5 ref. En, ja] [Dept. of Food Chem. and Tech., Fac. of Fisheries and Animal Husbandry, Hiroshima Univ., Fukuyama, Japan]

Details are given of laboratory- and commercial-scale studies on production of crystalline glucose from cellulose hydrolysates by a double-salt method. Aspects considered include: crystallization by a vacuum-pan evaporation process similar to that used for manufacture of sucrose; factors influencing yield; crystal size; decomposition of the double salt; effects of seed crystal diam.; washing of the crystalline glucose; and analytical characteristics of the final product. AJDW

## 30

## New speciality glucose syrups. (In 'Molecular structure and function of food carbohydrate'.)

[Conference proceedings]

Madsen, G. B.; Norman, B. E.  
pp. 50-63 (1973) [4 ref. En] London, UK; Applied Science Publishers Ltd. [Novo Industrias, Copenhagen, Denmark]

Brief details are given of studies on the manufacture of speciality glucose syrups, including high DE syrups (DE 60-70 or 90-98) and high maltose syrups. Aspects considered include: enzymic processes (using bacterial α-amylase, fungal α-amylase, glucoamylase and β-amylases); combined acid/enzymic hydrolysis processes; and factors influencing the crystallization properties and carbohydrate composition of the syrups (enzyme concn., substrate concn., reaction time, starch liquefaction method, and repolymerization reactions). AJDW

## 31

## 5-acetyl-2,3-dihydro-1H-pyrrolizines and 5,6,7,8-tetrahydroindilizin-8-ones, odor constituents formed on heating L-proline with D-glucose.

Shigematsu, H.; Shibata, S.; Kurata, T.; Kato, H.; Fujimaki, M.

*Journal of Agricultural and Food Chemistry* 23 (2) 233-237 (1975) [35 ref. En] [Dept. of Agric. Chem., Fac. of Agric., Univ. of Tokyo, Bunkyo-ku, Tokyo 113, Japan]

Reaction products of equimolar mixture of L-proline and D-glucose heated at 200° for 6 min were examined. From the ethyl acetate extract of the reaction products, new nitrogenous compounds, 5-acetyl-2,3-dihydro-1H-pyrrolizine, 5-acetyl-6-methyl-2,3-dihydro-1H-pyrrolizine, 5-formyl-6-methyl-2,3-dihydro-1H-pyrrolizine, and 5,6,7,8-tetrahydroindilizin-8-one and its methyl derivative, were isolated and identified. In addition to the above compounds, the following were identified: 2-furfuryl alcohol, quinoline, 3,5-dihydroxy-2-methyl-4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one, 2-hydroxy-3-methyl-2-cyclopenten-1-one, and 2,5-dimethyl-4-hydroxy-3(2H)-furanone. Isolation and identification were based on preparative gas chromatography and spectroscopic methods (mass, IR, UV and NMR spectra). The nitrogenous compounds had a mild smoky, weak amine-like odour with a somewhat bitter burnt tone. The caramel and burnt sugar fragrance of 2-hydroxy-3-methyl-2-cyclopenten-1-one and 2,5-dimethyl-4-hydroxy-3(2H)-furanone seemed to be modified slightly toward roasted, bread-like nuance by the trace addition of these nitrogenous compounds. AS



## 32

[Filtration during starch syrup and glucose manufacture.]

Petrushevskii, V. V.

*Sakhernaya Promyshlennost'* 48 (11) 57-60 (1974) [Ru] [VNIIC, USSR]

Test results for new filtration equipment used in manufacture of starch syrup and glucose at the starch and syrup plant in Dnepropetrovsk are presented. The following filters were tested: disc, tubular, automatic plate, automatic FPAKM, and vacuum drum. Advantages and disadvantages of the individual types of filters are discussed, and also methods of increasing filtration rates. Good results were obtained with the automatic FPAKM filter. STI

## 33

Studies on the mechanism of color formation in glucose syrups.

Ramchander, S.; Feather, M. S.

*Cereal Chemistry* 52 (2) 166-173 (1975) [22 ref. En] [Dept. of Agric. Chem., Univ. of Missouri, Columbia, Missouri 65201, USA]

2 furans, 5-(hydroxymethyl)-2-furaldehyde (HMF) and 2-(2-hydroxyacetyl)-furan (HAF), were identified among the products produced during the heat-decomposition and colouring of a glucose syrup. Yields of both compounds increased with rate of colour formation in syrup. The mechanism by which these furans are produced (that is, via a nitrogenous Amadori product or via an acid-catalysed dehydration, both without fission of the C chain) was studied by producing HMF and HAF from a syrup which was adjusted to pH 2.5 and which contained D-glucose-2- $H^3$ . It is known that when D-glucose-2- $H^3$  is converted to HMF and HAF via amine condensation and Amadori rearrangement, radiochemically inert furans are formed; whereas in an acid-catalysed dehydration reaction of unsubstituted sugar, the resulting HMF is tritium labelled on aldehyde C and HAF on hydroxymethyl C. The resulting HMF and HAF produced in syrup were essentially radiochemically inert, thus indicating that these compounds were not produced via an acid-catalysed non-nitrogenous reaction. They are most likely produced via an Amadori compound in Maillard-type reactions. AS

## 34

The hydrogenolysis of commercial corn glucose syrup.

Abdel-Akher, M.; Ghali, J.; Raouf, M. S.; Rhoushdi, M.

*Stärke* 27 (4) 128-130 (1975) [15 ref. En, de, fr] [Fac. of Agric., Cairo Univ., Egypt]

Hydrogenolysis of commercial glucose syrup was carried out at 170°C and 60 atm pressure with Prolabo Rancy-nickel catalyst. 89.9% of glucose was converted to sorbitol after 2 h and 92.3% after 3 h of hydrogenation. Addition of Mg turnings (3 g to 12 g Prolabo catalyst in 250 ml glucose syrup) did not increase the hydrogenation. RM

## 35

[The manufacture of glucose low in nitrogen from grain (especially wheat) starches.]

David, F.

*Czechoslovak Patent* 156 939 (1974) [Cs]

Saccharified juice obtained from grain starch, with 20-25% DM, is hydrolysed with HCl, and neutralized with  $Na_2CO_3$  to a pH value of 4.7-5.0; following addition of filtering and decolourizing agents the liquid is alternately passed through filters together with the same juice acidified with HCl to pH 4.0-4.2; thus a continuous change in pH from 5.0 to 4.0 and vice versa is produced, and the nitrogenous substances are thus removed. STI

## 36

Some new uses for lactose in the light of the sugar shortage.

Anon.

*Milk Industry* 76 (4) 15-16 (1975) [8 ref. En]

This review-type article deals mainly with the use of  $\beta$ -galactosidase for hydrolysing lactose into glucose and galactose, covering preparation of glucose-galactose syrups which could be used instead of conventional glucose syrup or blended with other products to produce yoghurt, fruit juices etc. The conversion of lactose into the 2 sugars should help in solving the problem of lactose intolerance, eliminate or reduce saltiness in whey concentrates, and accelerate fermentation in lactic acid manufacture from whey. FL

## 37

Low calorie, cold water soluble quick set gelatin dessert.

Furda, I.; Feldman, J. R.; Malizia, D.

*United States Patent* 3 868 465 (1975) [En]

Solutions of polyglucose and gelatin are co-dried to yield the title product. IFT

## 38

[New confectionery product.]

Recas, F. (Generale Alimentaire)

*French Patent Application* 2 220 196 (1974) [Fr]

Syrup of glucose used in confectionery products, such as caramel [see FSTA (1973) 5 4L258], has a DE of 30-34, preferably 30-32; 44-55% of the syrup of glucose comprises polysaccharides having  $\geq 7$  monomeric groups. This DE imparts to the product desirable characteristics such as high water content, lack of hygroscopic properties, fluidity of the mix, and good sucrose crystallization. W&Co



## 39

**Confectionery ingredients. Specific gravity of carbohydrate solutions. IV.**  
Cakebread, S. H.

*Confectionery Production* 40 (11) 506-508, 526 (1974) [3 ref. En] [Knechtel Lab. Ltd., Skokie, Illinois, USA]

Measurement of sp. gr. by direct displacement is considered. A description is given of the Westphal balance, an instrument which gives a direct reading of sp. gr. In large production units sp. gr. of liquids must be known to convert a formula given in lb to liquid measure. 2 tables are included: wt. per imperial and US gal of glucose syrups and different commercial Baumes; and dry solids content of glucose syrups at different degrees of conversion.  
VJG

## 40

**Maize refining.**  
Muller, G.

*South African Food Review* 2 (1) 23, 25-26, 29, 31, 33 (1975) [En]

The historical importance of maize is discussed. Most of the world's maize (300 million tons in 1974) is used as animal feed. Approx. 5-8% of the total production throughout the world is wet milled. The composition and properties of corn steep liquor, refined yellow maize meal, gluten and starch are given in tabular form. Germ liquor contains 50% oil, which is extracted and refined. Starch slurry contains approx. 40% solids, and can be dried and modified or converted into glucose syrup. Data for the manufacturing processes are included. Cornflour, depending on its type, can be used in the canning or confectionery industry and ordinary cornflour may be used for the production of dextrins. South Africa exports starch to approx. 15 countries; some maize is also exported and the Maize Board controls home and export prices. Glucose syrup can be used in the canning and baking industries and for the manufacture of toffees, chocolate fillings, gums, pastilles and marshmallows. In USA, glucose syrup is used by 2 major soft drink manufacturers. The future of maize and the breeding of nutritionally superior var. are briefly discussed. GL

## 41

**[Physico-chemical properties of a sucrose/glucose/water mixture.]**

Zubchenko, A. V.; Oleinikova, A. Ya.; Buravleva, V. I.

*Khlebopekarnaya i Konditerskaya Promyshlennost'* No. 2, 22-23 (1975) [Ru] [Voronezhskii Tekh. Inst., USSR]

Sucrose solutions combined with other sugars (glucose, fructose, maltose) are used in sweet bakery products. The properties of these systems are governed by the ratio of the components. Physico-chemical properties of a

sucrose/glucose/water system in different concn. were studied. Solubility isotherms and curves showing the relationship between the amount of water in the saturated solution and glucose content were constructed. Sucrose and glucose simultaneously dissolved in water reduce each other's solubility. STI

## 42

**[Modification of the ferrocyanide version of the glucose oxidase method for determination of glucose.]**

Afanas'yeva, G. A.; Shcherbukhin, V. D.

*Prikladnaya Biokhimiya i Mikrobiologiya* 11 (3) 460-462 (1975) [3 ref. Ru, en] [Moskovskii Tekh. Inst. Pishchevoi Promyshlennosti, Moscow, USSR]

The modification of the original method of the authors [FSTA (1972) 4 9L642] consists in making the use of peroxidase superfluous in the ferrocyanide oxidation by  $H_2O_2$ , by increasing ferrocyanide concn. to 0.6% and carrying out the reaction at pH 5 (the optimal pH for glucose oxidase). In determination of glucose in starch molasses, the modified method gave good agreement with the Dahlqvist glucose oxidase method [Biochemical Journal (1961) 80, 547].  
SKK

## 43

**[Determination of the main sugars in molasses by paper chromatography.]**

Serrano, P.; Kopecky, J.

*Revista sobre los Derivados de la Cana Azucar* 9 (1) 15-20 (1975) [3 ref. Es, en]

The glucose, fructose and sucrose contents of molasses were determined quantitatively by partition paper chromatography using the ascending method with a solvent system of 6:2:2 v/v ethanol-n-butanol-trichloroethylene, and visualizing with 10% ammonium molybdate. After elution with 5 ml  $H_2O$ , the % of these sugars in the molasses in determined colorimetrically, using a Zeiss Spekol at 625 nm (with anthrone sulphite).  
AS

## 44

**[The effect of various organic and inorganic substances on the glucose crystallization process.]**

Sroczynski, A.; Zglinski, W.

*Roczniki Technologii i Chemii Zywnosci* 24 (3) 269-278 (1974) [15 ref. Pl, en] [Inst. Chem. Tech. Zywnosci, Politech., Lodz, Poland]

The effect of non-glucose constituents on the rate of glucose crystallization from supersaturated ( $\alpha$  1.1 and 1.4) aqueous solutions at 40°C was studied. Non-glucose additives were: (i) agar as 0.095-0.125% of the solution; (ii) hydrol added to glucose in amounts equal to 5-10% of the non-glucose; (iii) glucose crystallized from solutions containing 2.5-20.0% sucrose or maltose (in terms of glucose DM); and (iv) various amounts of NaCl, KCl, sodium



acetate or  $\text{KH}_2\text{PO}_4$ . Viscosity of (i) and (ii) was the same. The effect of viscosity on glucose crystallization was insignificant, but pronounced effects were exerted by impurities introduced with hydrol, viz. disaccharoses and salts (e.g.  $\text{NaCl}$ ). The slowdown of glucose crystallization was almost independent of the kind of salt but was dependent on its molar concn. [From En summ.] ELC

## 45

Reduction of the azo food dyes FD&C Red 2 (Amaranth) and FD&C Red 40 by thermally degraded D-fructose and D-glucose.

Ross, K. D.

*Journal of Agricultural and Food Chemistry* 23 (3) 475-476 (1975) [22 ref. En] [Quaker Oats Co., John Stuart Res. Lab., Barrington, Illinois 60010, USA]

FD&C Red 2 (Amaranth) and Red 40 are reduced by aqueous D-fructose, at 100, 77, 61 and 37.8°C and by aqueous D-glucose at 100°C to form a mixture of hydrazo and amine species. The half-reaction time decreases with increasing pH. No reaction was observed with either sugar at room temp. for 40 days. AS

## 46

A dextrin-dextrose-saccharin mixture as an alternative sweetener to sucrose. [Lecture]

Bruckdorfer, K. R.; Yudkin, J.

pp. 222-226 (1974) [9 ref. En, de, fr] [Dept. of Nutr., Queen Elizabeth Coll., London W8 7AH, UK]

A sweetener with  $\frac{1}{3}$  calorific value of sucrose developed by the Tenstar division of Rank-Hovis-McDougal Ltd., is discussed. The sweetener consists of a mixture of partially hydrolysed wheat starch and saccharin, which gives the mixture its sweetening power; the product is spray-dried to give the appearance of sucrose. Dextrin and dextrose are present and reduce the bitter after-taste of saccharin.

GL

## 47

[The sweetening power of fructose and glucose under different conditions.] Über die Süßkraft von Fructose und Glucose unter verschiedenen Bedingungen. [Lecture]

Fricker, A.; Gutschmidt, J.

pp. 143-153 (1974) [7 ref. De, fr, en]

[Bundesforschungsanstalt für Lebensmittelfrischhaltung, D-75 Karlsruhe, Federal Republic of Germany]

This review includes data on multiple-comparison tests carried out by the authors on the sweetening power of (i) fructose, (ii) sucrose and glucose in different vehicles. No difference was found between tea and mains water in the 5-60°C range, (i) tasting significantly sweeter at 5°C, and (ii) tasting significantly sweeter at 60°C. In lemon juice and grapefruit juice, (i) and (ii) showed broadly the same sweetness between 5° and 30°C, but at higher temp. the results varied, possibly because of hydrolytic decomposition of (ii). [See 7 11T524.] SKK

## 48

Immobilized enzymes produce high-fructose corn syrup.

Mermelstein, N. H.

*Food Technology* 29 (6) 20, 22-24, 26 (1975) [14 ref. En] [Food Technology, 221 N. LaSalle Street, Chicago, Illinois 60601, USA]

This article describes the development of a commercial process for producing high-fructose corn syrup, using immobilized glucose isomerase to isomerize the dextrose in corn syrup to fructose and thus obtain a sweeter product. IFT

## 49

Production of glucose/fructose syrup.

Aschengreen, N. H.

*Process Biochemistry* 10 (4) 17-19 (1975) [6 ref. En] [Novo Ind. AS, Copenhagen, Denmark]

By an all-enzymatic process starch can now be converted to approx. 50/50 mixtures of glucose and fructose. This paper describes the use of a combination of enzymes for this process, developed in the laboratories of Novo Industri A/S in Copenhagen. AS

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H. BROOKES  
ASSISTANT EDITOR





## 1

**Waste paper to glucose.**

Mandels, M.; Nystrom, J.; Bolger, D.

**Activities Report** 27 (1) 134-146 (1975) [11 ref. En] [US Army Natick Lab., Natick, Massachusetts, USA]

Enzymic conversion of waste cellulose materials to glucose syrups for use in the food industry is reviewed with inclusion of a flow diagram. Production of a complete cellulose complex from *Trichoderma viride* QU 9414, and pretreatment of substrates by ball milling to produce max. saccharification is briefly discussed. Some promising substrates for conversion are listed: milled bagasse gave 42% saccharification in 4 h, milled milk cartons 81% saccharification in 24 h at 50°C, pH 4.8. RM

## 2

**[Reduction of sugar usage in non-alcoholic drinks production.]**

Paszeko, T.

**Przemysł Fermentacyjny i Rolny** 19 (5) 33-34 (1975) [Pl] [Zrzeszenie Produkcji i Obrotu Napojami Bezalkoholowymi, Warsaw, Poland]

Production data for 1974 are given for non-alcoholic drinks. A starch plant in Ilawa due to start production in 1975 will substitute sucrose by glucose, starch syrup and fruit juice concentrates. In the last quarter of 1974, technological experiments and organoleptic evaluations were carried out with the 3 ingredients and 7 variants which differed in the amount of extract and the amount of kind of sugar, the sucrose content being reduced. About 15 000 t of sugar was saved during 1975. An increase of non-alcoholic drinks production is planned for 1976-1980. STI

## 3

**[Application of the mutual link between heat passage and modification of the mass for control of glucose crystallization.]**

Kleiman, I. L.; Gulyi, I. S.

**Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya** No. 1, 117-120 (1975) [8 ref. Ru] [Pishchepromavtomatika, USSR]

Control of the cooling of glucose massecuites on the basis of a rapid temp. fall was conducive to reduced productivity or to the formation of tiny crystals in a considerable number of cycles. Variations in the thermal capacity of the glucose massecuite during crystallization produced a minor effect on the massecuite cooling. Mass growth of crystals in the massecuite can be controlled by means of a probe indicating the rheological properties of the massecuite, with sufficient accuracy to satisfy control needs. operation of every crystallization cycle on the basis of an individual cooling curve is recommended; this curve is given by the rheological characteristics of the given cycle, thus establishing the state of equilibrium between the cooling rate and the crystallization rate. STI

## 4

**High fructose corn syrup. [Lecture]**

Wardrip, E. K.

**American Dairy Review** 37 (6) 18B, 18D, 18F (1975) [En]

In this article, which is an extract from a lecture presented at a Sugar and Other Sweeteners in Food Processing symposium held at Michigan State Univ. in March 1975, the author deals with the development of high fructose maize syrup and its prospects. The product made using *Streptomyces* glucose isomerase enzyme for converting glucose to fructose contains e.g. 42% fructose, 50% glucose and about 8% other saccharides, and has a greatly enhanced sweetness. Applications include ice cream, bakery products, carbonated beverages, still fruit drinks, confections and salad dressings. FL

## 5

**Corn syrup jellies.**

Cooper, N.

**United States Patent** 3 892 871 (1975) [En]

Flavoured jelly compositions contain 55-67% corn syrup solids, of which  $\geq 15\%$  is from high fructose corn syrup, a flavouring material, a gelling agent and sufficient acidifying agent to provide a pH of 1.5-3.5. IFT

## 6

**Will high fructose corn syrup sweeten your future?**

Robinson, J. W.

**Food Engineering** 47 (5) 57-61 (1975) [En] [A. E. Staley Manufacturing Co., Decatur, Illinois, USA]

High-fructose corn syrup is similar to sucrose syrup in sweetness and has a relatively low viscosity. It is produced by a multistage starch conversion process in which part of the resultant dextrose is enzymically isomerized to fructose. On a dry basis, the syrup contains 42% fructose, 50% dextrose and 8% higher saccharides; solids content is 71%. This paper pinpoints those foods and beverages in which high-fructose corn syrup can totally or partially replace invert syrup or sucrose, and discusses effects on product functionality and quality. Foods and beverages discussed are: still and carbonated soft drinks; frozen desserts and related dairy products, e.g. ice-cream; chocolate milk and fruit-flavoured beverages; baked goods and snacks; sugar confectionery; jams, jellies and preserves; pickles and relishes; canned fruits; pie fillings; salad dressings and sauces; and catsup. Factors to consider in replacing sucrose or invert syrup with high-fructose corn syrup include: differences in sweetness; effects due to reducing sugars; texture and other physical properties; and possible need for changes in storage and handling methods. The high fructose syrup must be stored at 85-95°F to prevent crystallization and colour development. JA





## 7

**An evaluation of the hypiodite oxidation method for the estimation of glucose and its application to the analysis of glucose-fructose ratio in sugarcane molasses and honey.**

Bose, S.; Singh, L.; Mukherjee, S.

*Indian Sugar* 24 (10) 861-864 (1975) [11 ref.

En] [Dept. of Organic Chem., Nat. Sugar Inst., Kanpur-17, India]

A simple and reliable method for estimating glucose and total reducing sugar in sucrose solutions by quantitative oxidation of the glucose in alkaline hypiodite is described. To reduce the Lobry de Bruyn rearrangement, oxidation conditions are strictly controlled, using  $\text{Na}_2\text{CO}_3$  in place of NaOH and reacting for 20 min at 18-20°C. Statistical analysis of results from 22 model mixtures showed insignificant deviations in the % glucose determined (at the 5% level of significance). Analysis of 4 samples of sugarcane molasses purified by column chromatography on charcoal and celite showed 0.1465-0.2927 g total reducing sugars in 2 g molasses, with glucose:fructose ratios of 0.91, 0.98, 1.16 and 1.09. Analysis of glucose in honey required no preliminary clean-up. Results for the 4 samples agreed well with standard methods. RM

## 8

**[The use of enzyme preparations in the Polish starch industry.]**

Remiszewski, M.

*Przemysł Fermentacyjny i Rolny* 19 (5) 3-5

(1975) [10 ref. Pl, ru, en] [Cent. Lab. Przemysłu Zmniaczanego, Poznan, Poland]

Amylolytic preparations are used in Poland for glucose production by the acid/enzyme method. The production method decreases risk of corrosion by acids and chlorine, glucose quality is improved, and starch consumption/production unit is decreased. A glucose production technology using an enzyme/enzyme system of  $\alpha$ -amylase and amyloglucosidase will be introduced into production soon; direct enzymic hydrolysis of starchy raw materials has been laboratory tested. STI

## 9

**Glucose syrups in soft drinks.**

Palmer, T. J.

*Soft Drinks Trade Journal* 29 (10) 358 (1975)

[En]

Glucose syrups, their composition and suitability for use in the soft drinks industry are briefly discussed. Advantages of using them in soft drinks are consistent quality, stable supply, and continuous savings. VJG

## 10

**[3-product technological scheme for glucose hydrate production.]**

Petrushevskii, V. V.

*Sakharnaya Promyshlennost'* 49 (3) 66-69 (1975)

[Ru] [Ukrkrakmalpatoka, USSR]

A 3-product technological scheme of glucose production is described in which an additional hydrolysis of hydrol is incorporated. Using this scheme, 70.86% of glucose is obtained with an

anhydrous starch consumption of 1284 kg/t glucose (containing 9% moisture). Glucose losses are 18%, but for a 2-product scheme the losses are 24%. This 3-product scheme can be introduced at recent and newly built plants. STI

## 11

**[Factors responsible for quality deterioration in commercial glucose during storage.]**

Ludvig, L.; Surjan, E.; Toth, J.

*Szeszpar* 23 (2) 72-75 (1975) [7 ref. Hu, de, fr]

[Szeszipari Kutato Intezet, Budapest, Hungary]

The factors responsible for the browning of glucose during storage, using various glucose juices withdrawn from industrial glucose plants and processed were investigated in the laboratory. The initial starch material must not contain >0.6-0.7% protein, with only small amounts of oil and fibres. Technological instructions must be strictly observed. After filtration, a pre-concentration to 28-32 Baume degrees is necessary, followed by a 2nd filtration. Hydrolysis to an identical dextrose unit value (DU) (62-65 DU for potato starch and 65 for wheat starch) is suggested. The optimal temp. for crystallization is important. Potato-glucose crystals are preferable for seeding. IF

## 12

**The sweetener revolution comes to Britain.**

Dingwall, A. L.; Campbell, H.

*Soft Drinks Trade Journal* 29 (9) 315-316 (1975)

[En]

Consideration is given to the following: the history of glucose syrups; the manufacture, properties and uses of high-fructose glucose syrup; and the effectiveness of this sweetener in squashes and carbonated drinks. VJG

## 13

**Pure fructose.**

Longden, P. J.

*Soft Drinks Trade Journal* 29 (10) 354-355

(1975) [En]

The difference between pure fructose and high-fructose glucose syrups, the history of their use as sweeteners, and properties and application, with particular reference to the soft drinks industry, are briefly outlined. VJG

## 14

**Dextrose conversion syrups.**

Hurst, T. L. (A. E. Staley Manufacturing Co.)

*United States Patent* 3 897 305 (1975) [En]

A conversion syrup of high dextrose content is produced by saccharifying under acid conditions a thinned starch hydrolysate to dextrose with glucoamylase at a pH sufficient to inhibit the reversionary action of the glucoamylase. IFT





## 15

**Production of glucose from maize grits - industrial process.**

Twisk, P. van; Meltzer, B. W.; Cormack, R. H. *South African Food Review* 2 (5) 137, 139, 141 (1975) [7 ref. En]

The production of glucose syrup, for use in sweet manufacture, from degermed maize grits is outlined. Saccharification with a single bacterial enzyme system was adapted to commercial scale production. A typical analysis of the syrup is given, including the ratio of different glucose polymers. The plant can also be used, with the addition of crystallization equipment, for the conversion of maize grits to dextrose. GL

## 16

**[Effect of various factors in the glucose crystallization process.] [Lecture]**

Sroczyński, W.; Zgliniński, W.

*Zeszyty Problemowe Postępów Nauk Rolniczych* No. 159, 219-225 (1974) [8 ref. Pl, ru, de] [Inst. Chem. Tech. Żywności Politech., Łódź, Poland]

The effect of various physical and chemical factors on the rate of crystallization of glucose in aqueous solutions with coeff. of supersaturation varying from 1.1 to 1.3 was studied. Factors examined were: increase in temp. from 20° to 45°C; addition of 0.05-0.4% agar-agar at a constant temp. (40°C); addition of hydrol in amounts to provide 5-10% non-glucose components; and addition of 2.5-20% sucrose or lactose to the solution. It was established that the viscosity, which was dependent on the small concn. of agar-agar added, had very little effect on the crystallization process; the impurities involved with addition of hydrol had a far greater influence, with the NaCl component of the hydrol being the decisive factor. Presence of disaccharides had a much lesser effect on crystallization than had been assumed. [See 8 3L252-254.] HBr

## 17

**A comparative study of carbon energy reserve metabolism of *C. tropicalis* growing on glucose and on hydrocarbons.**

Käppeli, O.; Aeschbach, H.; Schneider, H.; Fiechter, A.

*European Journal of Applied Microbiology* 1 (3) 199-211 (1975) [11 ref. En] [Inst. of Microbiol., Swiss Fed. Inst. of Tech. (ETH), Weinbergstrasse 38, CH-8006, Zürich, Switzerland]

Glycogen was markedly accumulated in *Candida tropicalis* growing on glucose with increasing limitation of external substrate supply. The same effect was caused by a N-free medium. The lipid content did not show any significant change in either case. On the hydrocarbon substrate, lipid increased as substrate availability decreased, whereas glycogen accumulation was only slight. However, the increase of lipid content on hydrocarbons did not reach the same level of accumulation as glycogen on glucose. In N-free medium both glycogen and lipids were accumulated, indicating that glycogen is not

substituted by lipids as the carbon energy reserve on a hydrocarbon substrate. A refined shift technique is also described. The disturbing influence of excess substrate at the beginning of a shift from glucose to hydrocarbons is avoided by a portioned substrate feeding according to the cell activity. AS

## 18

**Effect of cold on glucose metabolism by callus and tubers of *Solanum tuberosum*.**

Pollock, C. J.; Rees, T. ap

*Phytochemistry* 14 (9) 1903-1906 (1975) [9 ref. En] [Bot. School, Univ. of Cambridge, Downing Street, Cambridge CB2 3EA, UK]

This work was carried out in order to discover the immediate effects of low temp. on glucose metabolism by tissue of *Solanum tuberosum*. [<sup>14</sup>C]-Glucose was supplied to tubers, and to callus derived from tubers, for 3 h at 2 and 25°. The detailed distribution of label showed that lowering the temp. of both callus and tuber tissue to 2° caused a striking increase in the percentage of the metabolized label that was recovered in glucose-6-phosphate, fructose-6-phosphate, and glucose-1-phosphate. It is suggested that these results, together with the cold-lability of glycolytic enzymes, indicate that lowering the temp. of potato tissue reduces glycolysis in relation to the activities of other reactions involving hexose phosphates. AS

## 19

**Glucose syrups in food and drink.**

Palmer, T. J.

*Process Biochemistry* 10 (10) 19-20 (1975) [En]

The increased use of glucose syrups arises from their consistent quality, stable supply and cost advantages. The application of these syrups to confectionery, jams and jellies, soft drinks, canning, baking, fermentation, dietetic and infant foods, and ice creams is described. High maltose and fructose types will assume an important role in glucose syrups in the future. AS

## 20

**[Glucose syrups today. Characteristics and uses in the confectionery industry.] Glukosesirupe heute.**

Eigenschaften und Anwendungen in der Süßwarenindustrie.

Völker, H. H.

*Süßwaren* 19 (18) 698-700, 702-704 (1975) [De]

The dextrose equivalent value, carbohydrate composition and other characteristics of acid-, acid/enzyme- or enzyme-saccharified glucose syrups are discussed, together with their suitability for use in various types of confectionery. Fructose-containing glucose syrups are also considered. IN





## 21

**Selected physical properties of glucose syrup fractions produced by reverse osmosis. I. Specific rotation, average molecular weight, solubility rate.** Kearsley, M. W.; Birch, G. G.

*Journal of Food Technology* 10 (6) 613-623 (1975) [10 ref. En] [Nat. Coll. of Food Tech., St. George's Avenue, Weybridge, Surrey, UK]

A series of glucose syrup fractions in the range 15-67 dextrose equivalent (DE) were produced by reverse osmosis. Specific rotation, average mol. wt. and solubility rate were determined for each fraction. Similarly, these parameters were determined for a series of commercially produced glucose syrups and the data for both series subjected to a statistical analysis to establish any differences between the series for a particular property. No significant differences were established either for specific rotation or solubility rate but a significant difference was established between the average mol. wt. of a fraction and a commercial syrup of the same DE. The glucose syrup fractions were later found to contain relatively large amounts of inorganic salts and, after demineralization, specific rotation and average mol. wt. were redetermined. A significant difference was established between fractions before and after demineralization for both these properties, thus showing the importance of demineralization when measuring these parameters. AS

## 22

**Selected physical properties of glucose syrup fractions obtained by reverse osmosis. II. Hygroscopicity.**

Kearsley, M. W.; Birch, G. G.

*Journal of Food Technology* 10 (6) 625-635 (1975) [17 ref. En] [Nat. Coll. of Food Tech., St. George's Avenue, Weybridge, Surrey, UK]

A series of glucose syrups were prepared by the reverse osmosis fractionation of a commercial 43 DE glucose syrup and the carbohydrate composition of each determined by a paper chromatography technique. These fractions were dried to zero moisture content and the hygroscopicity of each determined. The method of drying of the fractions was found to influence the rate of moisture uptake but not the final moisture content in each sample and the presence of inorganic salts in a sample caused an elevation of rate of absorption of moisture and also final moisture content. An increase in time to reach an equilibrium moisture content was noted as DE increased. 5 commercial glucose syrups were compared with glucose syrup fractions of similar DE, and found to be more hygroscopic in all but one sample. Samples of dextrose and maltose were also studied and were found to have abnormal moisture absorption curves if not dried correctly. [See preceding abstr. for part I.] AS

## 23

**Tomorrow's promise: enzymatic systems at work.** Crocco, S. C.

*Food Engineering* 47 (7) 54-56. (1975) [En] [Food Eng., Box 2035, Radnor, Pennsylvania 19089, USA]

Methods available for the production of enzymes from microorganisms are described and the various uses of such enzymes in the food processing industry discussed. Particular reference is made to the conversion of cellulose (e.g. wood waste, garbage, waste paper) to glucose by enzymic hydrolysis. Glucose can be used as a food or feed, converted to chemical materials, converted microbially to single-cell protein, or fermented to produce ethanol. The use of microorganisms in producing various food components (e.g. vitamins, amino acids) is mentioned and the possibility of using microbial enzymes to modify food composition suggested. JA

## 24

**Economics of producing nutrients from cellulose.** [Lecture]

Dunlap, C. E.

*Food Technology* 29 (12) 62, 64-67 (1975) [24 ref. En] [Dep. of Chem. Eng., Univ. of Missouri, Columbia, Missouri 65201, USA]

This article discusses the production of glucose and single-cell protein from cellulose and the economics of producing them from various cellulose sources. The author concludes that production of nutritional carbohydrates and proteins from cellulose could stabilize the market prices for these items. IFT

## 25

**Convenience or fabricated foods: spin off of military R&D.**

Hollender, H. A.

*Cereal Foods World* 20 (11) 530-532 (1975) [2 ref. En] [Food Tech. Div., Food Eng. Lab., US Army Natick Development Cent., Natick, Massachusetts, USA]

Techniques of flexible packaging and reversible compression, preservation by ionizing radiation and the use of cellulose as a source of food, currently under development in the military context, are discussed with reference to their relevance to the civilian food markets of the future, and their advantages in terms of reduced energy and resource requirements. The US Army Food Irradiation Program is outlined with special reference to the development of techniques of radappertisation. A brief outline is given of a method for glucose production by cellulose-degradation, employing a cellulase produced by a mutant strain of *Trichoderma viride*. The saccharification process is cell-free, the fungus being filtered out to yield an enzyme 'broth' into which cellulose is introduced and degraded at 50°C and atmospheric pressure. JRR





## 26

**Flavourings for soft drinks.**

Felton, T.

**Food Processing Industry** 44 (528) 30, 32 (1975) [En]

Consideration is given to the effect of EEC membership on the soft drinks industry. The use of high fructose glucose syrup in soft drinks manufacture is discussed. The potential for improvement and variation in soft drinks flavours is stressed. VJG

## 27

**[Granulated beverage bases.]**

Watanabe Seika Co. Ltd.

**Japanese Patent** 5 033 144 (1975) [Ja]

Granular beverage bases are produced by mixing a beverage extract, e.g. natural juice, coffee or black tea, with a water and glucose solution. Additional anhydrous glucose is added and the product dried and granulated. IFT

## 28

**[Gluconeogenesis in ripening grapes (*Vitis vinifera* L.).] Gluconeogenese in reifenden Beeren von *Vitis vinifera*.**

Ruffner, H. P.; Koblet, W.; Rast, D.

**Vitis** 13 (4) 319-328 (1975) [29 ref. De, en]

[Inst. für Allgemeine Botanik, Univ., Zürich, Switzerland]

## 29

**New sweetener's big potential.**

Dingwall, A. L.; Campbell, H.

**Food Processing Industry** 44 (528) 23, 27 (1975) [En]

Principal applications of the nutritive sweetener high-fructose glucose syrup are outlined: namely, soft drinks, jams and preserves; ice cream and yoghurt; canning; wine, perry and cider; brewing; sauces and salad cream; confectionery; pie fillings; and bakery products. The first UK purpose-built plant for making this sweetener is scheduled for completion towards the end of 1976. VJG

## 30

**Process for forming a dry granular mixture which contains fructose and glucose.**

Suomen Sokeri Co.

**British Patent** 1 405 987 (1975) [En]

Dry granular mixtures of fructose and glucose are formed by combining an aqueous solution of approx. equal parts fructose and glucose solution (solids content  $\geq 94\%$  by wt.) with a similar dry crystalline mixture in an atm with RH  $< 30\%$ . IFT

## 31

**Continuous production of glucose from dextrin by glucoamylase immobilized on porous silica.**

Lee, D. D.; Lee, Y. Y.; Tsao, G. T.

**Stärke** 27 (11) 384-387 (1975) [7 ref. En, de, fr]

[Dep. of Chem. Eng., Iowa State-Univ., Ames, Iowa 50010, USA]

The performance of glucoamylase immobilized on a new silica ceramic support for production of glucose from starch hydrolysates (dextrins) is described, together with a flow diagram of the pilot plant used. The enzyme support consisted of silanized silica packed in a 5 ft  $\times$  6 in column. The glucoamylase solution was bound to the support by circulation with a 10% glutaraldehyde solution, to give 112 mg attached enzyme/g carrier with enzyme activity of 3000 units ( $\mu$ -mole glucose/min)/g carrier. The reactor was sterilized with  $\text{CHCl}_3$  and the dextrin feed was steam sterilized. Glucose production increased with increasing substrate flow rate through the reactor up to a max., above which retrogradation reduced the glucose yield. The standard procedure adopted used a substrate of 24% DE, temp. 40°C, pH 4.5, flow rate 0.25 gal/min, residence time (on voids vol.) 8.99 min; this produced 1000 lb glucose/day as a product containing 87-93% glucose in the dissolved solids. With substrates of DE  $> 24\%$ , or with significant retrogradation, the glucose concn. decreased. No enzyme deactivation was detected after 80 days of continuous operation. Bacterial counts of the product were very low (30-50/ml). ELC

## 32

**Gel permeation chromatography of glucose oligomers and changes in carbohydrate composition during hard candy manufacture.**

Sabbagh, N. K.

**Dissertation Abstracts International, B** 36 (2) 640: Order No. 75-16594 (1975) [En] [Massachusetts Univ., Amherst, Massachusetts, USA]

Effects of various parameters in gel permeation chromatography (GPC) on elution of glucose oligomers in 42° DE maize syrup were studied. Longer column length enabled separation of isomers of isomaltose/maltose; isomaltotriose/maltotriose and isomaltotetrose/maltotetrose.  $^{14}\text{C}$ -labelled glucose was incorporated in candy; analysis after processing by GPC and ion-exchange chromatography showed no polymerization or degradation of the glucose. Similar analysis of  $^{14}\text{C}$ -labelled fructose showed the formation of 2 polymer products but no degradation of the fructose. AMW

## 33

**The tastes of artificial sweeteners and their mixtures.**

Moskowitz, H. R.; Klarman, L.

**Chemical Senses and Flavor** 1 (4) 411-421 (1975)

[18 ref. En] [Food Sci. Lab., US Army Natick Lab., Natick, Massachusetts, USA]





Panels scaled the taste intensity (bitterness, sweetness) of artificial sweeteners, mixtures of artificial sweeteners, and glucose. Sweetness of glucose conformed to a power function, whereas neither sweetness of artificial sweeteners nor their bitterness did. The total taste intensity of mixtures was often lower than the taste intensities of the components, suggesting suppression, although in many instances the suppressive effects disappeared at high concn. AS

### 34

#### The hedonic tones of artificial sweeteners and their mixtures.

Moskowitz, H. R.; Klarman, L.

*Chemical Senses and Flavor* 1 (4) 423-429 (1975) [9 ref. En] [Food Sci. Lab., US Army Natick Lab., Natick, Massachusetts, USA]

Panels rated their liking or disliking of aqueous concn. of glucose, sodium and calcium cyclamate, sodium and calcium saccharin, and pairwise mixtures of artificial sweeteners at varying concn. Hedonic tones did not add arithmetically; the unpleasantness of a mixture was often substantially more than the unpleasantness of the components. Adequate predictions of hedonic tones of mixtures must be made by referring back to the taste qualities of the mixture. This necessity for intermediate steps (i.e. consideration of the sensory aspect) constrains considerably the development of models which predict mixture hedonics from the hedonics of the mixture components evaluated separately. AS

### 35

#### Isomerization of glucose to fructose by semipurified, cell bound and immobilized glucose isomerase from *Streptomyces* sp.

Park, Y. K.; Toma, M.

*Journal of Food Science* 40 (6) 1112-1114 (1975) [14 ref. En] [Univ. Estadual de Campinas, Fac. de Tecnologia de Alimentos, Campinas, SP, Brazil]

3 types of glucose isomerase (semi-purified, cell-bound and immobilized) were prepared by incubating *Streptomyces* sp. in culture medium containing xylose as an inducer. These enzymes were examined for isomerization of glucose to fructose and some other properties. It was found that isomerization by semi-purified enzyme in a batch system was higher than that by cell-bound enzyme after 70 h incubation at 65°C. A significant amount of glucose isomerase was ionically bound to activated DEAE-cellulose in 0.05M phosphate buffer (pH 7) and was found to be active in the isomerization of glucose to fructose in a column at 50°C. The immobilized glucose isomerase was less heat stable than free enzyme. The enzyme complex requires Mg ion for enzyme activity. IFT

### 36

#### [Isomerized glucose syrup. Applications in confectionery.] Isomerisierte Glukosesirupe - Einsatzmöglichkeiten im Süßwarenereich. Völker, H. H.

*International Review for Sugar and Confectionery* 29 (1) 5-7 (1976) [De]

The composition and characteristics (sweetness, crystallization characteristics, fp depression, osmotic properties, viscosity, storage life) of various types of isomerized (fructose-containing) glucose syrups are briefly discussed, together with their applications in the manufacture of jellies, gums, liquorice products, boiled sweets, chewing gum, ice cream and long-life bakery products. AJDW

### 37

#### Production of glucose from maize grits on commercial scale. [Lecture]

Twisk, P. van; Meltzer, B. W.; Cormack, R. H.

*Stärke* 28 (1) 23-25 (1976) [7 ref. En, de, fr] [Nat. Food Res. Inst., CSIR, PO Box 395, Pretoria 0001, South Africa]

An industrial process is described whereby maize grits are used as raw material for production of glucose syrup and dextrose. Glucose syrup production in a single enzyme system with bacterial  $\alpha$ -amylase at pH 6.0 and 85°C eliminates many disadvantages of the double enzyme system e.g. microbial infection, pH adjustment during the reaction, high enzyme costs, proteolysis. The syrup produced has a DE value of 38%, 0.3% ash and 0.03% N. The residue (DM basis) contains 44.7% protein, 1.9% ash, 2.9% crude fibre, 6.3% fat and 44.2% carbohydrates (mainly glucose). Optimal particle size distribution ( $\mu$ m) is 5.7% >1010, 27.0% >680, 46.2% >530, 13.5% >450, 4.6% >305, 3.0% >305. T distribution of different glucose polymers is shown in a gel chromatogram and a table. The plant can also be used for converting maize grits to glucose by an amyloglucosidase at pH 4 and 55°C, followed by deionizing and vacuum concn. RM

### 38

#### Enzymatic hydrolysis of waste cellulose.

Mandels, M.; Hontz, L.; Nystrom, J.

*Biotechnology and Bioengineering* 16 (11) 1471-1493 (1974) [31 ref. En] [US Army Natick Lab., Natick, Massachusetts 01760, USA]

Strains of *Trichoderma viride* and *Pestalotiopsis westerdijkii* were cultured on media containing cellulose and the activity of the cellulases produced was examined under a variety of conditions using various waste products rich in cellulose. *T. viride* was the more useful in that waste cellulose itself proved to be a suitable carbon source for cellulase production. Cellulose waste materials studied included: various paper and wood wastes, milk cartons, rice hulls, bagasse, certain fractions of municipal trash, and washed rumen fibres from bovine manure, together with a few pure cellulose





substrates. The extent of saccharification of the cellulose substrates was measured on 5% slurries after 48 h. Saccharification ranged from 2-92% and depended upon cellulose crystallinity, particle size, presence of impurities and the type of pretreatment used for the cellulose. Ball milling of the cellulose waste gave good particle size reduction, max. bulk density, and max. susceptibility to enzyme attack. Hammer milling, fluid energy milling, colloid milling, or alkaline treatments proved less satisfactory. Municipal trash and fibres from bovine manure provided good substrates for conversion of waste cellulose into crude glucose syrups. DMA

### 39

[High-fructose corn syrup. An economic assessment.]

Viton, A.

*Sucrierie Belge* 95 (2) 43-46 (1976) [Fr, de, en, nl]

### 40

Manufacture of compressed fruit, peppermint and dextrose tablets.

Riedel, H. R.

*Confectionery Production* 41 (10) 479-480 (1975) [En]

A description is given of the operation of the 'Glatt' turbulent film spray granulator. The dry ingredients are fed into the feed hopper, which is then moved into the turbulent film spray granulating unit for 1-2 min turbulent mixing time. The liquid ingredients are sprayed in, which typically takes 10-20 min. During this period the granulate is formed. The final drying in the fluidized bed occurs at temp. of 40-80°C. The prepared granulate is fed straight from this machine to the tableting machines. The Glatt installation works at a rate of  $\leq 400$  kg/h. A variety of recipes is presented for compressed tablets. VJG

### 41

[Adulteration of apple juice concentrate with starch hydrolysate.] Über eine Verfälschung von Apfelsaftkonzentrat mit Stärkehydrolysat. Niedmann, P.-D.

*Chemie Mikrobiologie Technologie der Lebensmittel* 4 (5) 132-135 (1976) [31 ref. De, en, fr] [Inst. für Getränkeforschung GmbH, Mainz in Nieder-Olm, Federal Republic of Germany]

The sequence of events relating to the analytical detection of an adulterated consignment of apple juice and identification of the extraneous material is described. The composition of a suspect juice was compared with that of authentic samples from the same country of origin, from which it differed in having an abnormally high content of sugar-free extract, a high glucose content, smaller amounts of ash, K and phosphate, and an exceptionally high chloride content. The high glucose content and the simultaneous increase in the sugar-free extract suggested adulteration with an incompletely hydrolysed glucose syrup; TLC confirmed the presence of maltose in the adulterated juice (and in

a reference sample of starch hydrolysate of similar concn.), and the absence of maltose in authentic juice samples. Further investigation at the source from which the consignment originated located a batch of 'sugar syrup' which when diluted to approx. the same concn. as the juice (12° Brix) showed similarly high glucose and sugar-free extract levels, a remarkably high Ca content and an absence of fructose, confirming the previous findings. Adulteration of apple juice in general is also considered; the pattern of the amino acid composition and the carboxylic acid content are shown to be useful criteria in detecting adulteration with other liquors (e.g. grape juice). BDH

### 42

[Sorption behaviour of fructose, glucose and sucrose melts prepared under different heating conditions.] Sorptionsverhalten von Fructose-, Glucose- und Saccharoseschmelzen unterschiedlicher Erhitzungsgrade. [Thesis]

Mauch, W.; Asseily, S.

127pp. (1975) [many ref. De, en] Berlin (West); Institut für Zuckerindustrie

Studies on composition and sorption characteristics of melts prepared from pure D-fructose, D-glucose and sucrose, and 2 samples of white sugar are described. Melts were analysed for sugar decomposition products and condensation products by GLC, paper chromatography and enzymic methods; initial moisture content was determined by drying and the Karl Fischer method, and sorption characteristics were measured by detn. of equilibrium moisture content, and by static and dynamic desiccator methods. Tables and graphs of results are given. Little decomposition occurred in fructose melts prepared at 120°C; decomposition and condensation products (including 5-hydroxymethylfurfural) were detected in fructose melts heated at 180°C. Glucose was more heat-stable than fructose; slight formation of condensation products (maltose, isomaltose) was observed at 150°C; this increased at 180°C. Intense decomposition of sucrose into fructose, glucose, 5-hydroxymethylfurfural etc. was observed during heating at 180°C. Initial moisture content of intensively-heated melts was higher than that of lightly-heated melts for all sugars studied. Equilibrium moisture content of fructose melts increased and that of glucose melts decreased with increasing intensity of heating. 2 stages were observed in changes in equilibrium moisture content of sucrose melts with increasing intensity of heating; an initial decrease, followed by an increase. Reasons for these differences in sorption behaviour are discussed. AJDW

### 43

Continuous conversion of modified starch to glucose by immobilized glucoamylase. (In 'Conversion and manufacture of foodstuffs by microorganisms' [see FSTA (1976) 8 8G509].) [Lecture]

Smiley, K. L.

pp. 79-86 (1972) [9 ref. En] [N. Regional Res.





Lab., Peoria, Illinois, USA]

Partially purified commercial glucoamylase was immobilized on (i) arylamino porous glass beads either by (a) reaction with glutaraldehyde or (b) diazotization and on (ii) DEAE-cellulose in the presence of low ionic-strength acetate buffers at pH 4.2. The bound enzymes were used to continuously convert modified starch substrates to glucose in stirred reactors.  $\alpha$ -Amylase-converted starch at concn. as high as 30% could be quantitatively converted to glucose. Half life of the glucoamylase-(ia) complex was 60 days; this was due to dissolving of the glass, not to the enzyme becoming inactive. The (ii)-glucoamylase complex lost activity as the cellulose became coated with insoluble starch degradation products. Glucose production/unit enzyme was at least  $10 \times$  greater with bound than with soluble enzyme. Preparation of the glucoamylase-glass complex appeared better by method (b) than by (a). AL

#### 4 4

[Sugar drying process.]

Teikoku Hormone Manufacturing Co. Ltd.

*Japanese Patent* 5 038 688 (1975) [Ja]

Water is removed from aqueous solutions of glucose and fructose by concn. in the presence of propylene glycol or glycerol. IFT

#### 4 5

**Industrial processes for the manufacture of high-fructose corn syrups.**

Barfoed, H. C.

*Abstracts of Papers, American Chemical Society* 171 (Centennial), CARB 48 (1976) [En] [NOVO Ind. A/S, Enzymes Div., NOVO Alle, DK-2880 Bagsvaerd, Denmark]

In recent years, high-fructose corn syrups manufactured by enzymic isomerization of glucose have gained a significant share of the industrial-sweetener market, particularly in the USA. This is due to the combined effect of increased sugar prices and considerable advances in isomerase enzymology, as well as application of the latter to industrial processes. An account of this development is given, covering both its enzymological and technological aspects. A number of different process types, including batch and continuous operations, are described, with the main emphasis on continuous isomerization in fixed- or expanded-bed columns. AS

#### 4 6

**Present and future applications of immobilized enzymes in the sweetener industry.**

Zaborsky, O. R.

*Abstracts of Papers, American Chemical Society* 171 (Centennial), CARB 47 (1976) [En] [Nat. Sci. Foundation, Washington, DC 20550, USA]

Topics discussed include immobilized enzyme technology historical and technical developments of the glucose-isomerization system, and applications of immobilized enzymes to systems of commercial interest to the sweetener industry. AS

#### 47

**$\mu$ Bondapak/carbohydrate - a versatile, high-pressure, liquid-chromatographic column for the ambient-temperature separation of carbohydrates.**

Conrad, E. C.; Palmer, J. K.

*Abstracts of Papers, American Chemical Society* 171 (Centennial), CARB 24 (1976) [En] [Waters Associates, Maple Street, Milford, Massachusetts 01757, USA]

The  $\mu$ Bondapak/carbohydrate column is suitable for analysis of food and food related carbohydrates. Simple modifications in solvent composition and/or flow rate make possible the rapid detn. of virtually all soluble sugars, including oligosaccharides, found in foods. Filtration is normally the only pretreatment required for liquid foods, for aqueous or alcoholic extracts of solid foods, or for analysing polysaccharide hydrolysates. Applications to corn syrups, honey, juices, food-waste sugars, and milk products are described. AS

#### 48

**[Studies on the nutritive value of Korean foods. VI.]**

Kim, K. K.; Kwon, H. H.; Kim, I. P.; Ahn, K. O.

*Report of the National Institute of Health* 10, 317-319 (1973) [18 ref. Ko, en] [Dep. Hygiene, Nat. Inst. Health, Seoul, S. Korea]

15 Korean foods including: cow's brain, blood, large intestine, stomach and lung; pig's liver, kidney, large intestine and small intestine; crayfish shark; Clavaria botrytis (a wild mushroom), Hypholoma sublateritium (a wild mushroom); and acid-hydrolysed starch syrup were analysed with respect to their proximate composition, minerals, and vitamins. KoSFoST

#### 49

**Processed food carbohydrates and their physiological properties in relation to structure.**

[Review]

Lee, C. K.; Kearsley, M. W.; Mylvaganam, A. R.

*Process Biochemistry* 11 (4) 18-21 (1976) [36 ref. En] [Nat. Coll. of Food Tech., Weybridge, Surrey, UK]

This review includes sections discussing the fraction of glucose syrups by reverse osmosis and by precipitation using alcohol, methods for determining the carbohydrate composition of glucose syrups, the sweetness of carbohydrates, and bitter-sweet interaction and time-taste relationship. JA

#### 50

**Glucose syrup fractionation.**

Birch, G. G.

*British Patent* 1 418 910 (1975) [En]

A reverse osmosis process for fractionating syrups to yield starch and glucose-free oligosaccharide fractions is described. IFT





## 51

**Reverse osmosis of glucose syrups.**

Kearsley, M. W.

*Stärke* 28 (4) 138-145 (1976) [9 ref. En, de, fr] [Nat. Coll. of Food Tech., St. George's Avenue, Weybridge, Surrey, UK]

Data are presented on the osmotic pressure of glucose syrup fractions obtained by reverse osmosis fractionation of a 43% DE commercial glucose syrup, and on membrane performance at different starting solids contents. Details regarding the production of glucose syrup fractions in the range 15-18% DE are given. The fractions produced consist of a narrower spectrum of sugars than is found in a commercial syrup of the same DE and thus offer new types of syrup to the industrial user. Reverse osmosis and ultrafiltration seem to offer the only feasible economic means of obtaining specialized sugars from glucose syrups. AS

## 52

**Comparison of the sweetness of glucose and fructose with their ring-thio analogs.**

Lindley, M. G.; Shallenberger, R. S.; Whistler, R. L.

*Journal of Food Science* 41 (3) 575-577 (1976) [18 ref. En] [New York State Agric. Exp. Sta., Geneva, New York 14456, USA]

5-thio- $\alpha$ -D-glucopyranose and 6-thio- $\beta$ -D-fructopyranose are shown to be significantly sweeter than  $\alpha$ -D-glucopyranose and  $\beta$ -D-fructopyranose, respectively, when tasted in crystalline form. In solution, only the thio analogue of glucose is significantly sweeter than its parent sugar. The mutarotational formation of a nonsweet tautomer of thio-fructose in solution probably accounts for its fall in sweetness intensity. Reasons for the greater sweetness intensity of these thio analogues are proposed. 5-thio- $\beta$ -D-fructofuranose is shown to be essentially tasteless. IFT

## 53

**Production of sweet syrups from dextrose mother liquor.**

Suekane, M.; Hasegawa, S.; Tamura, M.; Ishikawa, Y. (CPC International Inc.)

*United States Patent* 3 935 070 (1976) [En]

A starch hydrolysate containing dextrose, maltose, isomaltose and oligosaccharides is subjected to enzymic isomerization to convert a portion of the dextrose to laevulose. The isomerized liquor is treated with an enzyme preparation with isomaltase or transglucosidase activity to produce a syrup which is sweeter and contains a higher amount of monosaccharides than the starch hydrolysate. IFT

## 54

**New Tilbury factory will make high fructose corn syrup.**

Woollen, A.

*Food Manufacture* 51 (5) 57-58 (1976) [En]

The maize processing plant, being built by Royal

Scholten-Honig (Holdings) Ltd. of Slough at the Port of London Authority's grain terminal in Tilbury, will become operational in 1977, producing high fructose corn syrup (Isomeroose). The development of the method for producing Isomeroose is outlined. Maize from storage silos is sieved, steeped in acidified water, and wet-milled, during which process starch, germ, bran and proteins are separated. The purified starch in water suspension is enzymically converted to dextrose, and the solution (DE 98) is conc. by evaporation and decolorized with active C. The pure dextrose solution is then passed through columns filled with immobilized enzyme in a granular form where part of the dextrose is converted to fructose. The solution obtained is purified and conc. to a syrup of the required specification. Isomeroose contains 42% fructose, 55% dextrose and 3% polysaccharides. It is used as a replacement for sucrose in soft drinks, canned fruits and vegetables, jams and preserves, bakery products, soft confectionery, and dairy products and desserts. JA

## 55

[Comparative determination of sugar by gas chromatographic, enzymic and reductometric methods.] Vergleichende Zucker-Bestimmungen mit gaschromatographischen, enzymatischen und reductometrischen Methoden.

Zürcher, K.; Hadorn, H.

*Deutsche Lebensmittel-Rundschau* 72 (6) 197-202 (1976) [18 ref. De] [Zentrallab. der Coop Schweiz, Basel, Switzerland]

Comparative studies were conducted on 3 methods for detn. of sugars: (i) GLC; (ii) enzymic procedures; and (iii) the reductometric method of Poterat & Eschmann [Mitteilungen aus dem Gebiete der Lebensmittel Untersuchung und Hygiene (1954) 45, 312-329 & 329-331]. Trials were conducted with raspberry syrup, 'grenadine' syrup, glucose syrups and fondant mass. Tables of results are given for concn. of various sugars determined by the 3 methods studied. All 3 methods gave highly-reproducible results. In general, results with (i) and (ii) agreed closely, whereas results with (iii) differed considerably, giving too high results for sucrose and reducing sugars. This inaccuracy in (iii) is attributed to the presence of reducing oligosaccharides and dextrans. (i) gives the best information on the spectrum of sugars present; (ii) is the preferred method for detn. of glucose and fructose in the presence of fruit acids. AJDW

## 56

[By-products and losses of sugar during continuous fermentation of starchy raw materials.]

Nakhmanovich, B. M.; Yarovenko, V. L.; Makeev, D. M.; Belov, E. M.

*Fermentatsiya i Spirtovaya Promyshlennost'* No. 2, 8-11 (1976) [7 ref. Ru] [VNIIPrB, USSR]

The reactions during continuous alcoholic fermentation of 11-12% wheat or barley mashings under laboratory conditions were studied; ethanol





content in 13 various by-products was determined. The chemical processes taking place during alcoholic fermentation form the basis for calculating the equivalent consumption of glucose to form each of the substances found. An example of the calculated balance (the original raw material being 10.667% glucose) is: for ethanol 9.8454% glucose, glycerin 0.2543% glucose, acids 0.0640% glucose, higher alcohols 0.0865% glucose, the rest of the by-products 0.0080% glucose, yeast cell biomass 0.2939% glucose, and residual sugars of the mash 0.1150% glucose. STI

## 57

### [Determination of trace quantities of glucose and other additives in sorbitol.]

Svetlaeva, V. M.; Zagorevskaya, E. V.; Kuznetsova, L. G.; Yanotovskii, M. Ts. *Zhurnal Analiticheskoi Khimii* 31 (1) 113-116 (1976) [6 ref. Ru, en] [Vses. Nauchno-issled. Vitaminnyi Inst., Moscow, USSR]

From analyses of 4 samples of technically pure sorbitol by gas chromatography of acetylated derivatives, the presence of glucose was proved in 2 samples, and the presence of 2 unidentified but closely related materials in all samples. The results were in accordance with those of previous analyses of 10 samples by colorimetry, using the colour reaction with 2,3,5-triphenyltetrazoliumbromide; these analyses demonstrated a content of reducing matters from 0.06 to 0.3% in individual samples. STI

## 58

### [Kieselguhr used as a filtration medium for processing glucose syrups.]

Kurochitskii, Ch. K.; Ilyushina, L. D. *Sakharnaya Promyshlennost'* No. 1, 64-65 (1976) [Ru] [VNIIEK, USSR]

The effect of kieselguhr on the quality of glucose syrups was investigated, employing practices commonly used in starch-syrup manufacturing plants. Due to a shortage of compressed air in the laboratory, filtering under vacuum was investigated. The filtering unit is illustrated. The measurements obtained assist better characterization of the types of kieselguhr. The best was the S-2 kieselguhr. STI

## 59

### [Spectrophotometric evaluation of glucose purity.]

Gulyuk, N. G. *Sakharnaya Promyshlennost'* No. 1, 66-67 (1976) [Ru] [VNIIEK, USSR]

The intensity of colour of dissolved glucose preparations after preliminary treatment for removal of interfering substances is a basis for breaking down the solutions into 3 groups: (i) samples manufactured by acidic hydrolysis of starch (highly polluted); (ii) samples made by enzymic hydrolysis of starch; (iii) recrystallized glucose (highest purity, used for medical purposes). An

empirical equation to determine glucose purity is presented. The measurements were made at 280 nm. STI

## 60

### Enzymatic determination of glucose: applications of the Enzymax Glucose Analyzer. [Lecture]

Sullivan, J. P.; Patel, K.; Wasilewski, J. C. *Publications of Technical Papers and Proceedings of the Annual Meeting, Sugar Industry Technologists* 34, 33-39 (1976) [32 ref. En] [SuCrest Corp., Brooklyn, New York, USA]

Following a brief discussion of methods of measuring reducing sugars, with particular reference to the enzymic detn. of glucose, the Enzymax Glucose Analyzer is discussed in detail and its application to granulated and raw sugars mentioned. The instrument, manufactured by Leeds & Northrup Co. (North Wales, Pennsylvania, USA), consists basically of a peristaltic pump, a reactor column, an amperometric detector and a digital readout. A buffer reagent (pH 6.5) with a bacteriostatic agent is used to set the instrument to zero and as a solvent for samples. Test solution is pumped at 5 ml/min through a filter and an enzyme column containing 0.5 ml glass beads; the beads contain on their surface covalent coupled or immobilized glucose oxidase. Glucose in the test solution is oxidized in the presence of the oxidase to  $H_2O_2$  and gluconic acid. The solution then passes through a heat exchanger and the amperometric detector which releases electrons from the  $H_2O_2$ . This release is detected and amplified to a digital display of the current which is directly proportional to the quantity of glucose in the test solution. The measurement range is 0-50  $\mu$ g glucose/ml. [See also FSTA (1975) 7 11A581.] [See FSTA (1976) 8 11L814.] JA

## 61

### [Use of high-maltose glucose syrup in the manufacture of boiled sweets.]

Bernal, S.; Torregrosa, R.; Biosca, A. *Alimentaria* No. 74, 55, 57, 59-60, 63-71 (1976) [14 ref. Es] [Dep. de Analisis Instrumental, Fac. de Ciencias, CEU, Alicante, Spain]

The potential value of high-maltose glucose syrups for use as an ingredient in boiled sweets is discussed, with reference to comparative studies on sweets made with various proportions of high-maltose syrup, 42 DE glucose syrup, sucrose and glucose. Aspects considered include: processing characteristics; product quality (hardness, sweetness, colour, hygroscopicity); incidence of defect (surface crystallization, adhesiveness, softening); effects of temp. and RH on deterioration; structure (determined by X-ray diffraction); and fructose content. Tables and graphs of results are given. It is concluded that high-maltose syrup may have considerable potential for manufacture of boiled sweets; it permits considerable reduction in the sucrose content of the sweets without adverse effects on quality. AJDW





## 62

**A model for enzymatic isomerization of D-glucose to D-fructose in a batch reactor.**

Sproull, R. D.; Lim, H. C.; Schneider, D. R.  
*Biotechnology and Bioengineering* 18 (5) 633-648 (1976) [9 ref. En] [School of Chem. Eng., Purdue Univ., W. Lafayette, Indiana 47907, USA]

Using whole cells containing glucose isomerase, mathematical models for the enzymic conversion of D-glucose to D-fructose and for the inactivation of the enzyme catalyst have been postulated and verified experimentally. The heat of reaction, the equilibrium constant, and the individual rate constants and their activation energies have been estimated. The model can be used to predict the time course for enzymic production of fructose in a batch reactor within the tested experimental range of 40-80°C. AS

## 63

**[Acid hydrolysis of lactose.]**

Barbetti, P.; Chiappini, I.  
*Industria Alimentari* 15 (6) 63-66 (1976) [12 ref. It] [Istituto di Chimica delle Sostanze Naturali, Univ. degli Studi, Perugia, Italy]

A TLC/colorimetric technique for quantitative detn. of reducing sugars was used to investigate acid hydrolysis of lactose. 3.6 g lactose monohydrate was dissolved in 30 ml 2N acetate buffer solution at pH 3.80. The solution was then refluxed, 2-ml samples of the mixture being taken approx. every 8 h for subsequent TLC and colorimetry. A study was also made of caramelization of lactose, galactose and glucose at 120°C; measurements were made of the pH of the resultant fractions, as well as their optical density at 490 nm and (after 1:100 dilution) at 285 nm. The absorption curves at these 2 wavelengths were plotted against time for lactose hydrolysis and for the caramelization of the 3 sugars. In the latter reaction galactose exhibited the greatest reactivity and glucose the least. The lactose hydrolysis mixture showed a close spectrophotometric analogy with the lactose, glucose and galactose caramelization mixtures and also with the lactose-glycine Maillard reaction mixture (work to be published). It is hypothesized that all 3 reactions lead to common intermediate products of the furan type, such as hydroxymethylfuraldehyde. ADL

## 64

**[Hydration 'numbers' of glucose in dilute aqueous solutions.]**

Zhmyrya, L. P.; Dadenkova, M. N.; Danileiko, V. M.; Burdukova, R. S.; Lysyanskii, V. M.  
*Pishchevaya Promyshlennost' Respublikanskii Mezhdovedomstvennyi Nauchno-tekhnicheskii Sbornik* No. 21, 15-17 (1975) [4 ref. Ru]

The numbers are calculated from the auto-diffuser coeff., measured by means of spin echo. An equation is given for using the data thus obtained to compute the auto-diffusion coeff. The known values

of the auto-diffusion coeff. then serve to compute directly the sought 'hydration numbers' of glucose in dilute aqueous solutions. The hydration numbers at 25°, 40° and 60°C are 11.0, 8.7 and 3.8, respectively. The concn. of the studied aqueous solutions of glucose was not >5%. The results show a significant reduction of the hydration number of glucose with increasing temp. STI

## 65

**Study of meat volatiles associated with aroma generated in a D-glucose-hydrogen sulfide-ammonia model system.**

Shibamoto, T.; Russell, G. F.  
*Journal of Agricultural and Food Chemistry* 24 (4) 843-846 (1976) [43 ref. En] [Dep. of Food Sci. & Tech., Univ. of California, Davis, California 95616, USA]

The volatile compounds produced by heating a model system of D-glucose-hydrogen sulphide-ammonia were entrained on Porapak Q and subsequently desorbed and transferred to a glass capillary column for separation and identification. Gas chromatographic and MS methods were used to identify 34 of the major components. The compounds identified included a thiol, sulphides, thiophenes, thiazoles, and furans. Thiophene and furan derivatives were the major volatile constituents of this reaction mixture which gave roast beef-like aroma. AS

## 6.6

**[Apparatus and process for enzymic catalysis.]**

Fresnel, J.-M.; Trosset, D. (Switzerland, Batelle Memorial Institute)

*Swiss Patent* 564 602 (1975) [Fr]

Enzymic catalysis is particularly suitable for the oxidation of glucose to gluconic acid, e.g. for improving the keeping properties of fruit juice or for removing sugar from eggs prior to the manufacture of powdered egg. Glucose in an aqueous medium is brought into contact with the electrode which contains a glucose oxidase fixed in the conducting support. The electrode is alternately raised to first and second potentials, one leading to the release of O<sub>2</sub> on the electrode and enzymic oxidation of the glucose by means of the O<sub>2</sub> generated, while the second potential is controlled to regulate the speed of oxidation. This method can also be used in other food processes, e.g. cheesemaking. W&Co

## 6.7

**Health laws and regulations - Argentina.**

World Health Organization

*International Digest of Health Legislation* 26 (4) 717-719 (1975) [En] [Geneva, Switzerland]

A selection of health laws and regulations is presented, including the following which relate to food hygiene: Decree No. 1013 of 29 March, 1974, amending various sections of the Argentine Food Code by redefining the standards for rice, glucose syrup, dextrose and lactose; and by introducing a section dealing with dehydrated glucose syrup; and





Decree No. 51 of 10 July, 1974, partially amending the Argentine Food Code in respect of additives permitted for use in certain non-alcoholic beverages. A revised version of Section 751 prescribes that the following additives may be added to flour during bread-making: sodium or potassium bromate,  $\leq 7.0$  g/100 kg flour; azodicarbonamide,  $\leq 4.3$  g/100 kg flour; or ascorbic acid,  $\leq 200$  mg/kg flour. VJG





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FAB 20

USE OF GLUCOSE IN FOOD PRODUCTS

SELECTED FROM VOLUME 9

FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

under the direction of

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H. BROOKES

ASSISTANT EDITOR





1

[Investigations of the Maillard reaction. XII. Formation of pyridone derivatives from maltose and lactose.] Untersuchungen zur Maillard-Reaktion. XII. Bildung eines Pyridon-Derivates aus Maltose and Lactose.

Severin, T.; Loidl, A.

*Zeitschrift für Lebensmittel-Untersuchung und -Forschung* 161 (2) 119-124 (1976) [15 ref. De, en] [Inst. für Pharmazie & Lebensmittelchemie, Univ., Sophienstrasse 10, D-8000 Munich 2, Federal Republic of Germany]

Maltose and lactose react with methylammonium acetate in hot aqueous solution to yield a dark brown mixture from which 1,2-dimethyl-3-hydroxy-4-pyridone can be isolated (by extraction with methylene chloride and vacuum distillation) and identified by elementary analysis and NMR- and IR-spectrometry. This substance is also formed, but in much smaller yields, from similarly heated glucose. The same pyridone results from heating isomaltol with methylammonium acetate, and from decarboxylation at 110-150°C of the pyridone obtained from isomaltol and glycine. 19 other volatile substances, known to be formed by heating maltose with methylammonium acetate, are listed. [See preceding abstr. for part XI.] GTP

2

[Glucose syrup and fructose as sweeteners for soft drinks.] Glukosesirup und Fruktose als Süßungsmittel für Getränke.

Ellerich, E.

*Brauwelt* 116 (19) 572-574 (1976) [De, en, fr] [Firma Rudolf Wild, 6900 Heidelberg, Federal Republic of Germany]

Use of glucose syrups, fructose or isomerase (high-fructose starch syrup) for sweetening of soft drinks is discussed, with reference to: physico-chemical properties; relative sweetness; effects of temp. and concn on sweetness; functional properties; storage; viscosity; effects on the taste of the product; costs; and legal aspects in various countries. TUB-IGB

3

[Better exploitation of all constituents in corn.]

Grebennik, I. E.; Malysko, G. N.

*Sakharnaya Promyshlennost'* 49 (12) 58-59 (1975) [Ru] [Verkhnedneprovskii Ind. Inst., USSR]

Examples of 2 integrated corn processing factories and 2 starch-syrup producing factories are used to show the percentages of starch, fodder, corn oil and corn steep obtained as well as their losses. Values are listed which represent losses of individual constituents of corn, and their monetary value. Exploitation of waste increases the efficiency of production of corn processing factories and can be considered a reserve source for increased fodder production. STI

4

[Glucose syrups and their derivatives in liquorice-based products.] [Lecture]

Zimmermann, M.

*Revue des Fabricants de Confiserie, Chocolaterie, Confiturerie, Biscuiterie* 51 (4) 14-26 (1976) [Fr]

The use of glucose syrups and derived products in liquorice production is reviewed under the following headings: nature and composition of products of starch hydrolysis (corn syrup, malto-dextrins, dextrin, sorbitol); properties of glucose syrups and derived products in liquorice production in relation to viscosity, anti-crystallizing capacity, hygroscopicity, reducing power (i.e. effect on browning, sweetness), brilliance (i.e. use for glazing) and nutritive value; and uses in hard, soft and liquid products. Recipes for a variety of products are tabulated. RM

5

Nonenzymatic browning kinetics in an intermediate moisture model system: effect of glucose to lysine ratio.

Warmbier, H. C.; Schnickels, R. A.; Labuza, T. P. *Journal of Food Science* 41 (5) 981-983 (1976) [21 ref. En] [American Can Co., Packaging R&D, Tech. Cent., Neenah, Wisconsin 54956, USA]

An intermediate moisture model food system, containing casein, glucose, glycerol, oil, microcrystalline cellulose and water, was used to study non-enzymic browning. The initial molar ratio of glucose to available lysine was varied from 0.5 to 5. The model food system samples were prepared to 0.52 water activity and were stored in sealed cans at 45°C and analysed periodically. The browning was followed by determining pigment accumulation, glucose utilization, and loss in available lysine. The rate of pigment formation followed zero-order kinetics after an initial short induction period. This rate increased linearly as the initial molar ratio of glucose to available lysine increased from 0.5 to 3. Above this ratio the rate did not change. The initial rate of glucose utilization and available lysine loss obeyed first-order kinetics, and increased as the initial molar ratio of glucose to available lysine increased from 0.5 to 5. This work shows that in the presence of glycerol, the initial condensation reaction is not the rate controlling step for pigment production. IFT

6

[Utilization of maize sugars in sugar-containing beverages in France. Glucose syrups, glucose syrups rich in fructose-dextrose, etc.] [Review]

Zimmermann, M.

*Bios* 7 (7-8) 3-12 (1976) [9 ref. Fr] [Dep. Alimentation, Ets. Roquette Freres, 62136 Lestrem, France]

The following aspects of maize sugars are discussed: nature, production and composition of products obtained by hydrolysis of maize starch (glucose syrups, dehydrated glucose syrups, malto-



dextrins, dextrose and sorbitol); general properties of maize sugars and their derivatives (viscosity, anti-crystallizing power, equilibrium RH, reducing power and browning, flavour and aroma, nutritive value, dietetic aspects, fermentability); and legislative aspects of the use of various sugars in sugar-containing beverages. JA

## 7

### Variations in the ratio of dextrose to levulose in sugarcane. [Lecture]

Irvine, J. E.

*Proceedings of the International Society of Sugar Cane Technologists* Vol. 2, pp. 1033-1039 (1974) [13 ref. En, es] [USDA, Houma, Louisiana 70360, USA]

Factors influencing the dextrose:levulose ratio (DL ratio) in sugarcane are discussed. Variables considered included: maturity; var.; location of cultivation; sucrose content and purity of the juice; effect of sugarcane mosaic infection; trash content of the cane sample; effects of burning; and effects of storage of the cut cane for 1 wk before testing. Tables of selected results are given DL ratio varied considerably with var. and location of cultivation; it decreased with increasing maturity and increasing % trash in the sample to be milled. DL ratio was inversely related to the sucrose content and purity of the juice. No significant effects of sugarcane mosaic infection, burning or storage of the cane on DL ratio were observed. [See FSTA (1977) 9 2L105.] AJDW

## 8

### Isomerization of dextrose.

Tamura, M.; Ushiro, S.; Hasagawa, S. CPC International Inc.

*United States Patent* 3 960 663 (1976) [En]

A process for the continuous isomerization of dextrose to fructose comprises passing a solution containing dextrose at pH 7.0-8.5 through a bed of immobilized dextrose isomerase and reactivating the bed as necessary by the passage of additional dextrose isomerase. IFT

## 9

### Low pressure gel chromatographic separation of oligosaccharides.

Wight, A. W.

*Stærke* 28 (9) 311-315 (1976) [15 ref. En, de, fr] [Nat. Food Res. Inst., PO Box 395, Pretoria 0001, South Africa]

A method is described for the separation and analysis of oligosaccharides by gel chromatography, using Bio-Gel P-2 (200-400 mesh) and Bio-Gel P-4 (200-400 mesh). Resolution of malto-oligosaccharides containing 13 glucose residues was obtained on both the P-2 and the P-4 columns. This resolution is slightly lower than that obtainable using the finer minus 400 mesh gel. However, when the 2 columns were connected in series, resolution of oligomers containing 15 glucose residues was

obtained. This resolution is comparable to that obtainable on a single P-2 minus 400 mesh column. Improved resolution of lower oligomers was obtained by recycle gel chromatography on the P-2 column. Some of the practical difficulties associated with the operation of a minus 400 mesh gel column were avoided as high pressure is not required to operate the 200-400 mesh gel columns. Results could be valuable for assessing glucose syrups for various applications. AS

## 10

### Ice cream - its present day manufacture and some problems.

Rothwell, J.

*Journal of the Society of Dairy Technology* 29 (3) 161-166 (1976) [3 ref. En] [Dep. of Food Sci., Reading Univ., Reading, UK]

Ice cream containing either milk fat or other fats is discussed under the following headings: Legal aspects, which, in the UK, can be classified under composition and heat treatment; Composition, which is dependent on type of product required and type of freezer used; Ingredients; Manufacture; Hardening; Storage and distribution; Quality control (chemical and microbiological); and Present day problems, which are caused mainly by increased costs of ingredients, especially milk SNF and sugar. Preliminary trials on the use of dried whey + soya flour in ice cream manufacture have shown promising results; acceptable products have been obtained by using 7.5% milk SNF + 2.2% demineralized dried whey + 1.5% soya flour in place of 11.2% milk SNF, or by replacing up to 50% of the sucrose with a glucose syrup suitably selected for the type of ice cream being manufactured. CDP

## 11

### [Microbial desaccharification of egg white.]

Stoyanova, L. G.; Vorob'eva, L. I.; Lobzov, K. I. *Prikladnaya Biokhimiya i Mikrobiologiya* 12 (4) 629-635 (1976) [18 ref. Ru, en] [Moscow State Univ., Moscow, USSR]

Glucose was eliminated from egg whites, using microorganisms, to prevent melanoidin formation which may damage the product. Desaccharification was achieved by use of *Acetobacter xylinum*, *Streptococcus lactis*, *Propionibacterium shermanii*, *Prop. petersonii* and propionic acid cocci. Optimal conditions of desaccharification were established, depending on the physiological characteristics of the above microorganisms. *Prop. shermanii* may be recommended for fermenting a liquid egg white. These bacteria have no proteolytic properties, do not utilize the egg white, but enrich it with vitamin B<sub>12</sub> and propionate, a preserving agent, during fermentation. AS

## 12

### Multifunctional sweetener.

Fruda, I.; Trumbetas, J. F. General Foods Corp.

*United States Patent* 3 971 857 (1976) [En]

Phosphoric acid is added to a heated solution of



glucose to catalyse polymerization. The solution is evaporated to form an acidified glucose syrup, which is vacuum heated and dried. IFT

## 13

**A comparison of two glucose syrup drinks with D-glucose monohydrate solutions as test loads in the glucose tolerance test.**

Green, L. F.

*Food Chemistry* 1 (1) 67-77 (1976) [19 ref. En] [12 Broad Reaches, Ludham, Great Yarmouth, Norfolk, UK]

2 commercial glucose syrup drinks manufactured from different glucose syrup, 'Lucozade' and 'Hycal' (Beecham Products), were compared with glucose monohydrates in glucose tolerance tests with 6 male and 6 female subjects. The glucose tolerance curves showed that the blood glucose profiles obtained were equivalent to those given by the monohydrate. RM

## 14

**[A Geotrichum strain isolated from a weaning calf mouth cavity.]**

Kato, E.; Tsuji, Y.

*Bulletin of the Faculty of Agriculture Meiji University [Meiji Daigaku Nogakubu Kenkyu Hokoku]* No. 37, 33-38 (1976) [9 ref. Ja, en] [Fac. of Agric., Meiji Univ., Ikuta, Kawasaki, Kanagawa, Japan]

A microbial strain was isolated from the mouth of a weaning calf, and identified as *Geotrichum candidum* Link ex. Pearson emend. by J. W. Carmichael. This strain successfully coagulates a soybean emulsion into a soft curd and, on addition of glucose, produces a fruity ester flavour which masks favourably the 'green' odour of the soybean. [From En summ.] JRR

## 15

**[Chemical and technological conditions for the isomerization of glucose syrups.]** Chemische und technische Voraussetzungen zur Herstellung von isomerisierten Glucosesirupen. [Lecture]

Gams, T. C.

*Stärke* 28 (10) 344-349 (1976) [41 ref. De, en, fr] [Miles Kalie-Chem. GmbH & Co. KG, Biochem. Werk, Hans-Böckler-Allee 20, D-3000 Hanover, Federal Republic of Germany]

The influence of process parameters on the enzymes used for isomerized glucose syrup production and hence on the isomerization process and its economy are discussed. The most commonly used enzymes, and their origin, properties and application in batch and continuous isomerization are reviewed. RM

## 16

**[Industrial conversion of glucose to fructose by the immobilized enzyme technique.]** [Review]

Schuchewytsch, G.

*Revue des Fermentations et des Industries Alimentaires* 30 (5) 132-137 (1976) [10 ref. Fr, nl] [Fac. des Sci. Agron., Univ. Catholique, Louvain, Belgium]

## 17

**[Economic and technical aspects of isomerized syrup production from starch.]** [Lecture]

Schwengers, D.

*Sucrerie Belge* 95 (11) 377-391 (1976) [10 ref. Fr, de, en, nl] [Pfeiffer & Langen, Dormagen, Federal Republic of Germany]

The economic aspects of isomerized syrup (IS) production from starch are markedly influenced by the raw material. The production of starch from wheat, maize and potatoes was compared (i.e. cost of the process, availability and cost of raw material/t IS, effect of the type of starch on saccharification, water consumption and pollution associated with starch production). After hydrolysis of the extracted starch or direct hydrolysis by the Kroyer process, the glucose syrup was converted to 42% fructose by glucose isomerase. This process requires strict temp., pH and time control (especially the continuous process in reaction columns.). The production costs of IS are tabulated, including costs of raw material, solid fuel, electricity and investment for production of 1000 kg IS vs. 1000 kg beet sugar. Total costs for 1000 kg IS were DM 1140. RM

## 18

**Process for making non-crystalline sugary materials from sugar and glucose syrup.**

Spriet, F. Creusot-Loire

*United States Patent* 3 983 862 (1976) [En]

Non-crystalline sugary matter for confectionery is manufactured by heating crystalline sugar and liquid glucose to 130°C in an extrusion machine with mashing screws. IFT

## 19

**Pilot plant conversion of cellulose to glucose.**

[Review]

Nystrom, J. M.; Andren, R. K.

*Process Biochemistry* 11 (10) 26, 28-31, 34 (1976) [20 ref. En] [US Army Natick Development Cent., Natick, Massachusetts 01760, USA]

The process basically involves production of a complex of cellulase enzymes from a fungus (*Trichoderma viride*) cultivated on cellulose, recovery of the extracellular cellulase by filtration, slurring the enzyme-rich broth obtained with pretreated cellulosic waste (e.g. milled newspaper) and reacting in a continuous reactor at 40-50°C under aseptic conditions; the principal product is a crude syrup containing glucose, cellobiose, xylose and a mixture of salts. A pilot plant utilizing this process is described with the aid of flow diagrams, and data obtained during various studies are tabulated. Consideration is given to the pretreatment at the substrate, the production and recovery of cellulase, and the hydrolysis of the substrate and recovery of sugar. JA



## 20

[A new glucose syrup.]

Avebe-Amylum Italia

*Industria Alimentari* 15 (12) 124-126 (1976) [It]

[Via C. Pisacane, 51-Milan, Italy]

A description is given of Isosweet, a glucose syrup with a high ( $\geq 42\%$ ) fructose content and a very low (0.05%) mineral content, produced by an enzymic method and purified by ion exchange. Data are given on its chemico-physical composition, bacteriological characteristics (total count, yeasts, moulds), viscosity (150 cP), solubility, sweetening power (equal to sucrose), taste and colour. Applications include soft drinks, sweets, jellies and ice cream. HBr

## 21

[Economic and technological aspects of isomerized syrup production from starch.] Wirtschaftliche und technologische Aspekte bei der Gewinnung von Isosirupen aus Stärke. [Lecture]

Schwengers, D.

*Zucker* 29 (11) 614-620 (1976) [10 ref. De, en, fr] [Pfeifer & Langen, 4047 Dormagen, Federal Republic of Germany]

See FSTA (1977) 9 4L325.

## 22

Recent advances in the use of enzymes in starch processing. [Lecture]

Fullbrook, P. D.

*IFST Proceedings* 9 (3) 105-112 (1976) [En]

After a brief summary of the history of enzyme utilization in starch processing, the author considers the use of amylase and glucose isomerase in the production of high fructose syrups (isosyrups). The 3 basic stages of fructose production from starch, i.e. liquefaction, saccharification and isomerization, are discussed. The efficiencies of the various liquefaction processes (acid, acid/enzyme, enzyme/enzyme) are compared, and use of the heat-stable enzyme Termamyl in starch liquefaction is mentioned. The mode of action of amyloglucosidase in saccharification of liquefied starches is outlined. A low-sheet of a continuous isomerization process for raw glucose syrup is given. The advantages of using insoluble enzymes for isomerization are listed. JA

## 23

[Chemical-analytical, physical and sensory studies of fresh 'Mettwurst'. I. The effect of various additives.] Chemisch-analytische, physikalische und sensorische Untersuchungen "Frischer Mettwurst". I. Der Einfluss verschiedener Zusatzstoffe.

Jöckel, J.; Weber, H.; Gerigk, K.; Grossklaus, D. *Archiv fuer Lebensmittelhygiene* 27 (4) 130-134 (1976) [19 ref. De, en] [Inst. für Veterinärmed.

(Robert von Ostertag-Inst.).

Bundesgesundheitsamt, 1000 Berlin (West) 33]

The 6 batches of 'Mettwurst' described in the previous paper [see FSTA (1977) 9 1S12] were examined at intervals for  $\leq 33$  days for reddening, fat, protein and salt contents, by penetrometer (Fa. Sommer & Runge) and by sensory assessment. Sausages with added glucose (G) or glucono- $\delta$ -lactone (L) retained their quality unchanged throughout; those with L showed pH values  $< 5.6$  and reddening values  $> 50\%$  already 1 day after manufacture, while those with G reached these values only after 6 days, and both G and L sausages had the sensory characteristics typical of soft raw sausage. Of the batches made without G or L, that with the lowest nitrite curing salt concn. was found spoiled on day 19, while the others kept well throughout; they had about the same sensory quality as G or L sausages but had higher pH (5.8-5.9) and less developed reddening (approx. 40%). SKK

## 24

Process for the enzymic isomerization of glucose to levulose.

Bouniot, A.; Guerineau, M. Rhone-Poulenc SA *United States Patent* 3 990 943 (1976) [En]

An aqueous solution of glucose is contacted with a glucose isomerase which has been previously treated with a cation exchange resin with Mg and Co ions fixed thereto. The glucose isomerase remains combined with the metal ions during isomerization. The use of the instant complex prolongs the working life of the enzyme and minimizes the need for conventional pH control. GL

## 25

[Thermal decomposition of D-glucose. I. Dry pyrolysis of D-glucose in flowing nitrogen.] Die thermische Zersetzung von D-Glucose. I. Die trockene Pyrolyse von D-Glucose im Stickstoffstrom.

Prey, V.; Eichberger, W.; Gruber, H.

*Staerke* 29 (2) 60-65 (1977) [19 ref. De, en, fr] [Inst. für Chem. Tech. organischer Stoffe, Tech. Univ., Getreidemarkt 9, Vienna A-1060, Austria]

Dry pyrolysis of glucose was examined with a pyrolysis-GLC apparatus (including a multi-purpose sampling system) at 250-500°C. The quantities of reaction water and of 11 volatile organic compounds formed were used to deduce the reaction mechanisms and the composition of the polymeric condensation product in the residue. Results suggested that the polymeric product was not an oligo- or polysaccharide, but a furan compound. RM

## 26

Action of aqueous sodium hydroxide on glucose syrups.

Kearsley, M. W.

*Food Chemistry* 2 (1) 27-41 (1977) [22 ref. En]



[Nat. Coll. of Food Tech., Weybridge, Surrey, UK]

The effect of alkali concn. on glucose syrups was studied and the alkali number for a series of glucose syrup fractions and commercial glucose syrups was determined (alkali number: ml 0.1N NaOH consumed by 1 g starch during 1 h digestion at 100°C). Volatile acidity values were determined on 28 samples, DE 16, 24, 43, 52, 68 and 100 (D-glucose). The volatile acidity produced was shown to be dependent on NaOH concn. (0.1-2.0N), reaching a max. at 1.0N, and was directly related to DE. 2 methods of analysis of glucose syrup are described, the first concerning the detn. of the DE of glucose syrups, the second a theoretical example of the analysis of glucose syrup-sucrose mixtures. AS

## 27

**Immobilized enzyme technology.**

Weetall, H. H.

*Cereal Foods World* 21 (11) 581-584, 586-587 (1976) [20 ref. En] [Corning Glass Works, Corning, New York 14830, USA]

The state of the art of immobilized enzyme food processing is reviewed, with particular reference to glucose isomerase in the production of isomerized syrups, glucoamylase for starch hydrolysis and lactase, used in producing hydrolyzed whey sweeteners. JRR

## 28

**New technological developments in D-fructose production.**

Seidman, M.

*Abstracts of Papers, American Chemical Society* 170, CARB 25 (1975) [En] [Res. Cent., A. E. Staley Manufacturing Co., Decatur, Illinois 62525, USA]

Historically, the major industrial source of D-fructose has been invert syrup from sucrose. The commercial availability of immobilized D-glucose isomerase enzymes has resulted in production of high-fructose corn syrups at a rate > 1.2 billion lb/yr in the USA. These syrups contain 42% D-fructose, 50% D-glucose and 8% lower oligosaccharides. It is probable that, because of more favorable economics, corn starch will replace sucrose as the source of invert-type syrups. D-fructose-containing syrups have also been prepared from whey lactose that has been enzymically hydrolysed and then isomerized. Methods have recently been patented for separating D-fructose from D-glucose by ion-exchange chromatography, fractional crystallization from mixed solvent systems, and complex-salt formation. Lower cost crystalline D-fructose, as well as higher fructose content syrups, will soon become commercial realities. AS

## 29

**The general chemistry and properties of glucose syrups.**

Birch, G. G.

*Abstracts of Papers, American Chemical Society* 170, CARB 11 (1975) [En] [Nat. Coll. of Food Tech., Weybridge, Surrey, UK]

The overall major composition of glucose syrups is reviewed in terms of methods of manufacture, and the concept of degree of hydrolysis, distinguished by NMR spectrometry, is considered in relation to DE. 'Rare oligosaccharides' may occur in glucose syrups prepared by acid or enzymic methods due to reversion or transglycosylation reactions. Minor components of starch may affect the DE of products and, in the resulting syrups, also offer possible clues to their methods of preparation and manufacture. New avenues for improving the range and properties of glucose syrups available for food use appear to be opened by the technique of reverse osmosis. This allows the preparation of either very low or very high DE syrups, as well as intermediate range types devoid of both low and high mol. wt. components. AS

## 30

**Enzymes in starch processing.**

Barfoed, H. C.

*Cereal Foods World* 21 (11) 588-589, 592-593, 604 (1976) [En] [Novo Ind. Ltd., Copenhagen, Denmark]

The action of amylases employed in producing sugars from starch substrates is described for malt enzymes ( $\alpha$ - and  $\beta$ -amylase), bacterial and fungal  $\alpha$ -amylases, glucoamylase,  $\alpha$ -1,6-glucosidases and glucose isomerases. The applications in starch processing are discussed with reference to the manufacture of dextrose (glucose), and isomerized syrups. JRR

## 31

**Production of glucose syrup from maize grits with special reference to gel chromatographic analysis. [Lecture]**

Twisk, P. van; Wight, A. W.

*Stærke* 28 (12) 432-435 (1976) [12 ref. En, de, fr] [Nat. Food Res. Inst., PO Box 395, Pretoria 0001, South Africa]

Direct enzymic hydrolysis for producing glucose syrup from maize grits instead of maize starch requires consideration of economic factors, nature of raw material (possible solubles from grits which may complicate filterability and refining), and control of reaction conditions. Reaction patterns were readily followed from a series of chromatograms obtained by gel chromatography. Hydrolysis for 6 h with bacterial + fungal amylase produced (as % of TS) 25% glucose ( $G_1$ ) and 35% maltose ( $G_2$ ), and 24 h saccharification produced 43%  $G_1$  and 27%  $G_2$ . Production (%) of  $G_1$ ,  $G_2$  and



maltotriose ( $G_3$ ) was respectively: 17, 25, 13 at pH 6.0; 23, 28, 14 at pH 5.2; and 23, 19, 15 at pH 4.8. Saccharification of maize starch for 6 h at pH 5.2 produced (%) respectively 9, 37 and 19 with both enzymes and 4, 7 and 8 with bacterial enzyme alone; the latter syrup contained a high % of higher oligomers which rendered it very suitable for confectionery use. RM

### 32

[A simple polarimetric method for the determination of glucose in jams and fruit syrups.] Hussein, M. A.; Hamada, A. S.; El-Badawi, A. A. *Elelmiszervizsgalati Koezlemlenyek* 22 (3) 157-163 (1976) [5 ref. Hu, ru, de, en] [Food Tech. Dep., Univ. Mansoura, Egypt]

A rapid polarimetric orientation was developed for detection of glucose added to jams or syrups, and for approx. detn. of the ratio of glucose to sucrose. The clarified and filtered solution of the sample is subjected to hydrolysis, the DM content determined by refractometry is adjusted to 6% or 10%, and the rotatory power of both solutions is measured. The amount of added glucose can be estimated on the basis of the difference between the rotatory powers of the solutions, with the aid of tabulated values. IF

### 33

**Dextrose from starch.**

Wachter, J. P.

*Abstracts of Papers, American Chemical Society* 173, AGFD 80 (1977) [En] [Miles Lab. Inc., Marschall Div., 1127 Myrtle Street, Elkhart, Indiana 46514, USA]

Dextrose from starch sources is a major raw material for production of products by fermentation. Corn is the principal source of starch for dextrose in the USA at the present and is likely to maintain that position for some time. On a worldwide basis, there are several other renewable crop sources of starch which could be considered as economically viable sources of dextrose for fermentation. The problems and economics of obtaining starch from a representative selection of crop sources are examined and discussed. Conversion costs of starch to dextrose by enzymes including capital costs are also analysed and presented. AS

### 34

**Separation of fructose from a mixture of sugars.**

Odawara, H.; Noguchi, Y. Toray Industries Inc. *United States Patent* 4 014 711 (1977) [En]

A method is described for separation of fructose from a mixture of fructose and glucose by adsorption with crystalline alumino-silicate. IFT

### 35

**Process for preparing a sugar [dextrose] tablet.**

Nelson, A. L.; Skrabacz, D. J.; Young, B. CPC International Inc.

*United States Patent* 4 013 775 (1977) [En]

### 36

**Manufacture of high boiled sweets.**

Lees, R.

*Confectionery Production* 42 (11) 511-512 (1976) [En]

Consideration is given to the problem of colour formation during the manufacture of high boilings. Causes considered are: the presence of 5-hydroxymethylfurfural; a reaction between any proteins present and the dextrose; the presence of metallic contaminants; and the breakdown of dextrose during acid inversion. Other aspects considered are: degrees Baume as a guide to concn.; problems arising when comparing results quoted in the USA and in Europe due to different test conditions that may be used (e.g. gravity reading being quoted at 60° and 38° C, respectively); and at a given degree Baume and a given DE level glucose syrup from the different base materials may have different viscosities. VJG

### 37

**Manufacture of high boiled sweets.**

Lees, R.

*Confectionery Production* 42 (12) 547, 550-551 (1976) [En]

In this article dealing with ingredients used in the production of boiled sweets, consideration is given to the following properties of glucose syrup: DE value, total soluble solids content, sweetness, optical rotation, solubility, stability, refractive index, and humectant properties. [See preceding abstr.] VJG

### 38

**Manufacture of high boiled sweets.**

Lees, R.

*Confectionery Production* 42 (10) 457-458, 467 (1976) [En]

Various types of glucose syrups are discussed in relation to their use for the manufacture of high boiled sweets. Manufacture of glucose syrup by selective breakdown of starch using acid or enzymic hydrolysis is briefly outlined. Speciality syrups considered are: high dextrose enzyme converted syrups; high maltose syrup; 70DE glucose syrup; and low DE glucose syrup. The properties of the common types of glucose syrup are tabulated. [See preceding abstr.] VJG

### 39

**Methods of test for starch hydrolysis products. 1.**

**Determination of dry matter in acid hydrolysed glucose syrup, solid glucose and dextrose (refractive index method).**

United Kingdom, British Standards Institution *British Standard* BS 5256:Part 1, 15pp. ISBN 0-580-08865-0 (1976) [En] Price £3.50 [2 Park Street, London W1A 2BS, UK]

The method is applicable to glucose syrup and solid glucose syrup and solid glucose obtained by acid hydrolysis, to solutions of these products containing no insoluble material, to dextrose



whatever its manufacturing process, and to dextrose solutions. The method consists of detn. of refractive index of an undiluted product or a solution containing a known proportion of product, at a specified temp., and calculation of DM content by means of the given tables showing refractive index as a function of composition, concn. and temp. The tables given are not valid, in the present state of knowledge, for glucose syrups and solid glucose obtained by total or partial enzymic hydrolysis. AL

## 40

[Isomerized glucose syrup and its use in the fruit nectar industry.]

Gherardi, S.; Andreotti, R.

*Industria Conserve* 52 (1) 27-31 (1977) [2 ref. It, en, de, fr] [Sta. Sperimentale per l'Ind. delle Conserve Alimentari, Parma, Italy]

After describing the production, the main chemical, physical and microbiological properties and the storage of isomerized glucose syrups, the authors deal with their use in the preparation of fruit beverages and nectars (involving partial or total substitution for sucrose). Organoleptic evaluation and chemical analyses of pear and apricot nectars showed that satisfactory products were obtained when 50% sucrose was replaced by the isomerized glucose syrup. For fruits with high glucose and fructose concn. and low sucrose concn., up to 80% of sucrose could be replaced, though the effect of high concn. on sterility and colour formation during storage would have to be examined. RM

## 41

[Special investigations on enzymic isomerization of glucose to fructose.] Spezielle Untersuchungen über die enzymatische Isomerisierung von Glucose zu Fructose.

Tegge, G.; Hensen, C.; Kracht, E.

*Stärke* 29 (4) 129-135 (1977) [6 ref. De, en, fr] [Bundesforschungsanstalt für Getreide- & Kartoffelverarbeitung, Schützenberg 12, D-4930 Detmold 1, Federal Republic of Germany]

The effects of reaction conditions on isomerization of glucose by glucose isomerase (GI) were studied. The reaction rate increased with temp. up to 80°C and with pH, reaching a 50:50 equilibrium mixture in 53 h at 60°C and pH 6.0, or in 21 h at 60°C and pH 7.5. The accelerated isomerization was however attended by increased colour formation. The Co co-factor of GI could be replaced by increasing  $Mg^{2+}$  concn.: the amount of  $Mg^{2+}$  needed was dependent on the initial reaction rate and could be controlled by increasing the enzyme concn. Increasing  $Mg^{2+}$  concn. also had a favourable effect on the fructose:colour formation ratio. The isomerization rate was not significantly affected by sugar decomposition products e.g. hydroxymethyl furfural (HMF) or by low concn. of  $SO_2$  or  $Ca^{2+}$  (200 ppm); 400 ppm of  $Ca^{2+}$  reduced both GI activity and the isomerization equilibrium, and 0.5% HMF increased the colour formation. RM

## 42

[Production of starch hydrolysis products with low dextrose equivalent (DE).] Verfahren zur Herstellung von Stärkehydrolysenprodukten. Richter, M.; Schierbaum, F.; Augustat, S. German Democratic Republic, Akademie der Wissenschaften

*German Federal Republic Patent Application* 2 365 850 (1976) [De]

The products form thermo-reversible gels with water. High mol. wt. and low mol. wt. starch products, which differ in their mean degree of polymerization by a factor of  $> 10$ , are mixed in such a ratio that the low mol. wt. proportion represents more than half the wt. 170 g potato starch (15.6% moisture) was stirred with 328 ml water to form a uniform suspension (28.8% solids). The pH-value was adjusted to 7 with 2N  $Na_2CO_3$  solution and the mixture transferred to the measuring section of a viscograph. After addition of 0.27 ml NOVO-bacteria- $\alpha$ -amylase Liq. 60', the system was heated at the rate of 1.5°/min, the consistency being recorded as a function of time. The resulting hydrolysate, having a DE of 9.2%, is transferred to a beaker, boiled for 15 min to inactivate the enzyme, and cooled. It contains, after loss of water on boiling, 30.1% DM and does not solidify on cooling. W&Co

## 43

The production technology of demineralised glucose-galactose syrup from whey.

Poznanski, S.; Mieczkowski, M.; Bednarski, W.; Kowalewska, J.; Leman, J.; Chrzanowska, A.

*Nordeuropaeisk Mejeri-Tidsskrift* 42 (8) 265-273 (1976) [21 ref. En, Da, De] [Inst. Inżynierii i Biotech. Żywności, ART, Olsztyn, Poland]

A method is described for preparing glucose-galactose syrups (free from salty flavour) from cheese whey, which is demineralized by passing through cation and anion exchange columns of Wofatit-KPS and -SBV at a rate of 200 ml/min; after pasteurization at 85°C for 15 min, the demineralized whey is hydrolysed with  $\beta$ -galactosidase at 35°C for 5 h, and then evaporated at 40-60°C to about 10% of its original vol. The resulting straw-yellow glucose-galactose syrup has a pleasant, sweet, honeyed flavour. Production of low salt content syrups from partially refined lactose is also described. Practical uses for these syrups in the food industry are discussed briefly. MEG

## 44

[Possibilities of application of glucose-galactose concentrates in brewing.]

Poznanski, S.; Leman, J.; Bednarski, W.; Szmelić, W.; Kowalewska, J.; Chodkowski, M.; Wieliczko, R.

*Przemysł Fermentacyjny i Rolny* 21 (2) 1-4 (1977) [9 ref. Pl, ru, en, de] [Inst. Inżynierii i Biotech. Żywności ART Olsztyn, Poland]

Three types of malt substitutes in wort are used in the form of de-mineralized and non-demineralized glucose-galactose concentrates



obtained directly from whey or from partially purified lactose. The concentrates, demineralized in ion-exchangers, obtained from partially purified lactose, may replace 50% extract in malt, without impairing the brewing process and beer quality. Similar experimental substitution of extract in wort with non-demineralized concentrate shows that only up to 10% substitution is not detrimental to the finished beer quality. The stability of beer manufactured using the demineralized concentrate is very good. Sensory evaluation gives the highest ranking to the samples made using partially purified lactose. The beer flavour and taste are particularly enhanced. STI

## 45

Continuous fermentation of glucose solutions. Grinbergs, M.; Hildebrand, R. P.; Clarke, B. J. *Journal of the Institute of Brewing* 83 (1) 25-29 (1977) [25 ref. En] [Carlton & United Breweries Ltd., Australia]

Use of a continuous-flow plug fermenter to ferment glucose solutions was found to be possible only with unrefined commercial glucose and not with pure glucose. Even when the former was used problems were encountered due to gradual increase in back pressure across the yeast bed. With the commencement of glucose metabolism in the yeast bed, 'shock' excretion of  $K^+$  and  $Mg^{2+}$  as well as of low mol. wt. nitrogenous material was observed. The product from the fermenter contained an abnormally high level of  $\alpha$ -diketones, 1.3 mg/l. AS

## 46

[Manufacture of glucose and dextrans from protein-containing starches.] Verfahren zur Herstellung von Dextrose und Dextrinen aus eiweisshaltigen Stärken. Müller, H.

*German Democratic Republic Patent* 124 479 (1977) [De]

A process for manufacture of glucose and dextrans from protein-containing starchy raw materials (cereals or legumes) is described. After initial acid or enzymic hydrolysis of the raw material, fibre and insoluble proteins are removed by filtration or centrifugation. The carbohydrate and soluble protein in the filtrate or supernatant are then separated by ultrafiltration. The isolated carbohydrate fraction may be used for preparation of glucose or isomerized glucose syrup. The protein may be used as a food additive, as a substitute for albumen. IN

## 47

Glucose isomerization into fructose.

Fujita, Y.; Matsumoto, A.; Ishikawa, H.; Hishida, T.; Kato, H.; Takamizawa, H. Mitsubishi Chemical Industries Ltd., Seikagaku Kogyo Co. Ltd. *United States Patent* 4 025 124 (1977) [En]

A process is described for the isomerization of

glucose into fructose by contacting an aqueous glucose solution with glucose isomerase wherein  $Fe$  ion together with  $Mg$  ion is present in the reaction mixture. IFT

## 48

[Glucose. Test methods.]

Colombia, Instituto Colombiano de Normas Técnicas

*Colombian Standard* ICONTEC 1076, Spp. (1976) [Es]

This standard specifies the following test methods for glucose: detn. of  $Fe$  by ashing the sample, extraction of  $Fe$  with dil. HCl, reduction to the ferrous ion with hydroxylamine hydrochloride, and reaction of the ferrous ion with sodium acetate and o-phenanthroline to form a stable complex which may be determined by optical density measurements at 508 nm (the concn. being calculated on the basis of standard curves); detn. of starch by titration of a solution of the glucose under test (25 g in 25 ml water) against a 0.02N  $I_2$  solution; and testing a solution of the glucose for turbidity, by examination by transmitted light. AIDW

## 49

[Technology of production of demineralized glucose-galactose syrups.]

Poznanski, S.; Mieczkowski, M.; Bednarski, W.; Powalewska, J.; Leman, J.; Chrzanowska, A. *Przemysł Spożywczy* 31 (2) 62-65 (1977) [14 ref. Pl, ru, en, fr, de] [Inst. Inżynierii i Biotech. Żywności, Akad. Rolniczo-Tech., Olsztyn, Poland]

2 procedures were studied. In the 1st, cheese whey deproteinized at 92-95°C and pH 4.6 [see FSTA (1974) 6 2P256] was filtered through Zeitz KK-7 filters, demineralized on laboratory Wofatit KPS strong cationite and Wofatit SBV strong anionite (both from German Democratic Republic) columns (ionite capacity, 1200 ml) at the optimal throughflow rate of 200 ml/min, pasteurized at 85°C for 15 min, cooled to 40°C, pH was adjusted to 6.5 using N NaOH, and the whey was hydrolysed for 5 h at 35°C with a  $\beta$ -galactosidase preparation from *Saccharomyces fragilis* (activity, 10 µmol glucose/mg of protein/h). The hydrolysate (solid residue, > 80%) was acidified to pH 5.5-5.8, filtered and concentrated 2-10 $\times$  in a vacuum evaporator at 40-60°C. Demineralization after hydrolysis led to greater sugar losses on the ionite columns. In the 2nd, industrial scale, procedure deproteinized whey from production of Serum [see FSTA (1975) 7 10P2148] or reprecipitates was concentrated 10-12 $\times$  in a Wiegand-type evaporator at 70°C, held for 48 h at 20°C, the uncrystallized liquor was separated by decantation, the lactose crystals were twice washed with water (1:1) at 1-2°C, dissolved at 60°C to a 4-6% solution, the  $\beta$ -galactosidase preparation was added at 2% of the lactose to the solution cooled to 40°C, and hydrolysis was carried out at 35-40°C for 3-5 h (70-95% of lactose



hydrolysed). The hydrolysate was concentrated 7-8 × in a Wiegand-type evaporator at 50-70°C.  
[Continued in following abstr.] SKK

## 50

[Technology of production of demineralized glucose-galactose syrups.]

Poznanski, S.; Mieczkowski, M.; Bednarski, W.; Kowalewska, J.; Leman, J.; Chrzanowska, A.

*Przemysł Spożywczy* 31 (2) 62-65 (1977) [14 ref. Pl, ru, en, fr, de] [Inst. Inżynierii i Biotech.

Zywności, Akad. Rolniczo-Tech., Olsztyn, Poland]

[Continued from preceding abstr.] Compositional data tabulated for deproteinized whey, non-demineralized syrup, syrup obtained by the 1st procedure (demineralization/hydrolysis, (concn. 9 ×) and 2nd procedure (concn. 8 ×), respectively: DM 39.2 and 37.2, total N compounds 0.23 and 0.17%, extent of hydrolysis 88.2 and 85.6%, and ash 0.33 and 0.87%; both were clear yellow liquids of sweet taste and pleasant odour. A proposed manufacturing line for d/h is diagrammatically shown. From preliminary calculation, the syrups described should cost less/kg than potato starch syrup. SKK

## 51

Method for isomerizing glucose syrups.

Cotter, W. P.; Lloyd, N. E.; Hinman, C. W.

Standard Brands Inc.

*United States Patent Reissue* 28 885 (1976) [En]

This is a reissue of United States Patent 3 623 953. A process for enzymic isomerization of glucose to fructose in a glucose-containing liquor employs a salt of sulphurous acid to reduce denaturation. IFT

## 52

Production of high purity glucose syrups.

McMullen, W. H.; Andino, R. Novo Industri AS

*United States Patent* 4 017 363 (1977) [En]

A starch solution which has been enzymically liquified to produce dextrin is saccharified enzymically with amyloglycosidase to yield a syrup containing >98% glucose on a dry solids basis. IFT

## 53

Effect of altered dextrose equivalent on nutritional quality and flavor of Whey Soy Drink. [Lecture]

Holsinger, V. H.; Womack, M.; Sutton, C. S.;

DellaMonica, E. S.; McDowell, P.; Talley, F.;

Farrell, H. M., Jr.

*Journal of Dairy Science* 60 (suppl. 1) 39 (1977) [En] [ERRC, USDA, Philadelphia, Pennsylvania, USA]

Substitution of either 28 DE maize syrup solids or 10 DE hydrolysed cereal solids for 42 DE maize syrup solids in the Whey Soy Drink formulation caused no significant change in the standardized protein efficiency ratio (PER) or apparent N digestion of the beverage powder, initially or after 6

months storage at 37°C. The 42 DE controls were ranked sweeter than the 28 DE and 10 DE products, but when these products were scored against a hidden 42 DE control only the 10 DE product received a lower flavour score ( $P < 0.05$ ). [See FSTA (1977) 9 11P1719.] DMK

## 54

The effect of butylhydroxyanisole (BHA) on amino acid and carbohydrate concentrations during heating.

Maga, J. A.; Monte, W. C.

*Lebensmittel-Wissenschaft und -Technologie* 10

(3) 139-140 (1977) [5 ref. En] [Dep. of Food Sci. & Nutr., Colorado State Univ., Fort Collins, Colorado 80523, USA]

The effect of 200 ppm BHA in retarding the rate of destruction of amino acids heated in glass vials for 15 min at 124°C was examined. Both heated and unheated controls, neutralized to pH 7.0, were employed, and the effect of similar treatments on solutions of glucose and sucrose was also studied. The amounts of free amino acids remaining after autoclaving were determined using standard GLC techniques. Significant reductions in the reactivity of amino acids heated in the presence of BHA were observed for all acids, except histidine, and also for glucose and sucrose. Actual losses varied widely, <5% aspartic acid being destroyed in the presence of BHA, compared with approx. 80% for tyrosine; other amino acids for which losses exceeded 50% were serine, valine and glycine. It is inferred that BHA is effective in reducing the rate of non-enzymic browning accompanying heat sterilization, but that appreciable changes in the level of free amino acids may still occur. BDH

## 55

Carbohydrate/iron complex formation.

Kearsley, M. W.; Birch, G. G.

*Food Chemistry* 2 (3) 209-217 (1977) [13 ref.

En] [Nat. Coll. of Food Tech., Univ. of Reading, St George's Avenue, Weybridge, Surrey, UK]

The concn. of  $Fe^{2+}$  and  $Fe^{3+}$  in conjunction with the concn. of selected carbohydrates necessary for chelation of the Fe are described, together with a reappraisal of the spectral evidence for chelate formation. The formation and isolation of  $Fe^{3+}$ /fructose and  $Fe^{3+}$ /high fructose-glucose syrup complexes (as possible dietary carriers of inorganic Fe) are described, and an analysis is presented. AS

## 56

[Problems of hydrolysis of sugars and glucose syrup with hydrochloric acid (sucrose inversion).] Zur Problematik der Hydrolyse von Zuckern und Glucose-sirup mit Salzsäure (Saccharose-Inversion).

Zürcher, K.; Hadorn, H.

*Mitteilungen aus dem Gebiete der*

*Lebensmitteluntersuchung und Hygiene* 68 (2)

200-212 (1977) [11 ref. De, fr] [Zentrallab. der Coop Schweiz, CH-4002 Basel, Switzerland]



In continuation of earlier experiments [see FSTA (1976) 8 11A624 and (1977) 9 4A295], behaviour of different sugars was studied under conditions of mild acid hydrolysis according to Schoch & Alschwang (15 min in boiling water bath at pH 1-2) and under conditions of the modified Federal German Customs regulations using stronger acid for 5 min at 68-70°C [for both references, see Schweizerisches Lebensmittelbuch, Ed. 5 (1964) Vol. 1, p. 561; Eidgenössische Drucksachen- und Materialzentrale, Bern, Switzerland]. Products of hydrolysis were examined for reducing capacity with copper complexone solution, and by GLC and enzymic methods. Sucrose was almost completely split into fructose and glucose; maltose and, particularly, lactose showed only negligible increase in reducing power, but underwent marked hydrolytic or chemical changes. Oligosaccharides and dextrans were also partly decomposed. It is concluded that sucrose detn. in complex mixtures by measurement of reducing power before and after hydrolysis are of doubtful value. SKK

## 57

### Tautomeric equilibria of D-glucose and D-fructose: polarimetric measurements.

Hyvönen, L.; Varo, P.; Koivistoinen, P.  
*Journal of Food Science* 42 (3) 652-653 (1977)  
[11 ref. En] [Dep. of Food Chem. & Tech., Univ. of Helsinki, SF-00710 Helsinki 71, Finland]

The influence of temp. and concn. on the tautomeric equilibria of glucose and fructose was measured polarimetrically. Proportion of  $\alpha$ -anomer in the equilibrated glucose solutions at 23°C grew from 33 to 39% when the glucose concn. increased from 5 to 60%. Temp. had only a slight effect on the anomeric equilibrium of glucose. At the tautomeric equilibrium of fructose at 0.5°C the proportion of fructopyranose was 77%; at 61°C it was 48%. The proportion of fructopyranose at 23°C grew from 67% to 73% as fructose concn. increased from 5 to 80%. [See also following 2 abstr.] IFT

## 58

### Tautomeric equilibria of D-glucose and D-fructose: gas-liquid chromatographic measurements.

Hyvönen, L.; Varo, P.; Koivistoinen, P.  
*Journal of Food Science* 42 (3) 654-656 (1977)  
[15 ref. En] [Dep. of Food Chem. & Tech., Univ. of Helsinki, SF-00710 Helsinki 71, Finland]

The effects of temp., concn. and solvent on the tautomeric equilibria of glucose and fructose were determined by GLC as trimethylsilyl (TMSi) ethers. 4 tautomeric forms of fructose as their TMSi ethers were identified by GLC-MS and IR spectroscopy. The results of the GLC measurements indicate that the proportion of the  $\alpha$ -anomer at the equilibrium of glucose solutions increased slightly both with increasing concn. and temp. In pyridine there was somewhat more  $\alpha$ -D-glucose at equilibrium than in water solutions. The relative amounts of the fructose tautomers in water solutions varied only slightly as a function of concn. whereas the amount of the furanose forms increased clearly with

increasing temp. In the pyridine solutions of fructose less pyranose forms were found than in the water solutions at corresponding temp., whereas in pyridine solutions at constant temp. the pyranose forms increased with increasing fructose concn. [See also preceding abstr.] IFT

## 59

### Tautomeric equilibria of D-glucose and D-fructose: NMR spectrometric measurements.

Hyvönen, L.; Varo, P.; Koivistoinen, P.  
*Journal of Food Science* 42 (3) 657-659 (1977)  
[9 ref. En] [Dep. of Food Chem. & Tech., Univ. of Helsinki, SF-00710 Helsinki 71, Finland]

The influence of temp. and concn. on the anomeric equilibrium of glucose was determined by <sup>1</sup>H NMR spectrometry and on the tautomeric equilibrium of fructose by <sup>13</sup>C Fourier transformation NMR spectrometry. The proportion of the  $\alpha$ -anomer at the equilibria of glucose solutions was approx. constant at 5% and 10% concn. at different temp. At higher concn. (20, 50 and 65%) the proportion of the  $\alpha$ -anomer at equilibrium was increased at higher temp. The proportion of both  $\alpha$ - and  $\beta$ -fructofuranoses was increased at the equilibrium of 20% fructose solutions at higher temp. The tautomeric equilibrium of fructose remained approx. unchanged in the 20, 50 and 80% fructose solutions at room temp. [See also preceding abstr.] IFT

## 60

[Sorption characteristics of fructose, glucose and sucrose melts subjected to various degrees of heat treatment.] Sorptionsverhalten von Fructose-, Glucose- und Saccharoseschmelzen unterschiedlicher Erhitzungsgrade.

Mauch, W.; Asseily, S.  
*Forschungsbericht, Institut für Zuckerindustrie Berlin* No. 1, 127pp. (1975) [many ref. De, en]  
[Inst. für Zuckerind., Amrumer Strasse 32, 1 Berlin (West) 65]

Studies were conducted on the composition and sorption characteristics of fructose melts (heated at 120° or 180°C), glucose melts (heated at 150° or 180°C) and sucrose melts (heated at 180°C). Composition of the melts was evaluated enzymically, by GLC and by paper chromatography; moisture content was determined by drying and by Karl Fischer titration. Tables and graphs of results are given. At equal temp. (180°C), fructose underwent greater decomposition than glucose intense decomposition of sucrose melts was observed. The glucose content of the sucrose melts was higher than the fructose content; this is attributed to the superior heat stability of glucose. Moisture content of highly-heated melts was higher than that of moderately-heated melts. The equilibrium moisture content of cructose increases and that of glucose decreases with increasing intensity of heating. This difference is attributable to differences in the mol. wt. and solubility characteristics of the decomposition products of these 2 sugars. 2 phases were observed in changes



in the equilibrium moisture content during heating of sucrose melts: initially, equilibrium moisture content decreased, as a result of formation of monosaccharides and other highly-soluble compounds; it then increased, as a result of formation of high mol. wt. condensation products. AJDW

## 61

[Wheat and maize as raw material for production of sugar.] Weizen und Mais als Rohstoff für die Zuckergewinnung.

Tegge, G.; Schlumbohm, F. W.

*Getreide, Mehl und Brot* 31 (5) 122-126 (1977)

[6 ref. De] [Bundesforschungsanstalt für Getreide- & Kartoffelverarbeitung, Detmold, Federal Republic of Germany]

Equimolecular glucose/fructose syrup (iso-syrup) can be produced from starch (wheat, maize, barley or potato) by successive liquefaction with  $\alpha$ -amylase at pH 6.0 and a temp. of 80-90°C, followed by treatment with gluco-amylase at pH 4.0 and 60°C, followed in turn by treatment by glucosyltransferase at pH 6.2 and 60°C. The iso-syrup can be used as a sweetener as a replacement for saccharose; by 1980, 30% of the sugar requirements of the USA are expected to be met by iso-syrup. Production statistics for iso-syrup in the EEC are also favourable. Harvest trends in the Federal Republic of Germany for sugar beet, potatoes, maize, wheat and barley are considered to the year 2000. Maize has the steepest rise and sugar beet the lowest. 'Sugar' yields from wheat, barley, maize, potatoes and sugar beet are tabulated for the years 1974 and 2000. JVR

## 62

Production of high saccharified syrups by two-stage enzymatic hydrolysis of potato starch.

Sroczyński, A.; Pierzgański, T.; Nowakowska, K. *Acta Alimentaria Polonica* 3 (2) 107-114 (1977) [5 ref. En, pl] [Dep. of Chem. Food Tech., Tech. Univ., Lodz, Poland]

Production of highly saccharified syrups (DE 50-70) entirely by enzyme hydrolysis was studied, i.e.  $\alpha$ -amylase for the 1st stage of starch liquefaction and glucoamylase (GA) for the 2nd stage of saccharification. The major objective was to reduce the high cost of GA by reducing the quantity used. Two  $\alpha$ -amylase and 3 GA preparations were used in a series of experiments with starch milk (30% concentrate). These were: (i) 1st stage  $\alpha$ -amylase at optimum pH 6.0 and 2nd stage GA at optimum pH 4.5; (ii)  $\alpha$ -amylase and GA combined at pH 6.0 followed by pH 5.2; (iii) combined enzymes at pH 7.0 and 4.5; and (iv) combined enzymes at constant pH 6.0 throughout. Six GA concn. were used (from manufacturers suggestion to one-tenth of this). DE was determined at intervals from 4.5 to 48 h reaction time. If high saccharification is required in a short time (e.g. 6 h) a high GA concn. and separate pH stages are needed, but by extending the reaction

time good DE values are possible with one-tenth GA concn.; (iv) avoids production of salts from pH adjustment. Thus at 48 h, DE values were (i) 72.8, (ii) 71.4, (iii) 70.3 and (iv) 68.2. ELC

## 63

[Possibilities for processing and utilization of milk protein and major milk components.]

Poznanski, S.

*Elelmezési Ipar* 31 (3) 103-107 (1977) [33 ref. Hu, ru, en, de] [Agric. Univ., Olsztyn, Poland]

The author describes new products (Serwit ripened cheeses, protein concentrates, twarog, dried twarog and dried milk) made by Polish methods in which milk proteins (casein + whey proteins) are separated with min. heat denaturation. It is claimed that the new methods increase cheese yield by 16-20%, with 90-92% protein retention and 98% fat retention [see FSTA (1976) 8 3P575 & 9P1776]. Dried whole milk produced on the basis of the new technique is reconstituted to 20% TS for use in manufacture of various cheese products, with similar high levels of protein and fat utilization. The dried milk does not differ from traditional dried whole milk in composition, except that the denaturation of the whey protein is much less severe. The final part of the article discusses developments in lactose utilization, including the production of demineralized glucose-galactose syrups using ion-exchange treatment of crystallized lactose from whey. ADL

## 64

[Possibilities for processing and utilization of milk protein and other milk components.]

Möglichkeiten der Verarbeitung und Nutzung von Milcheiweiss und anderen Milchbestandteilen.

Poznanski, S.

*Lebensmittel-Industrie* 24 (3) 124-126, 141-142 (1977) [33 ref. De, en, ru] [Landwirtschaftlich-Tech. Akad., Olsztyn, Poland]

See preceding abstr.





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H. BROOKES

ASSISTANT EDITOR





## 1

**Radiation-induced degradation of D-glucose in anaerobic condition.**

Kawakishi, S.; Kito, Y.; Namiki, M.

*Agricultural and Biological Chemistry* 41 (6) 951-957 (1977) [14 ref. En] [Dep. of Food Sci. & Tech., Nagoya Univ., Nagoya, Japan]

$\gamma$ -radiolysis of D-glucose in aqueous solution under anaerobic conditions was investigated. D-glucose was significantly decomposed by the action of a hydroxyl radical, a primary radiolytic product of water. Under anaerobic conditions, glucose radicals formed by hydrogen abstraction by hydroxyl radicals were dehydrated to give deoxygenated sugars, and a part of the radicals followed disproportionation reactions to afford dicarbonyl sugars. Among the products formed through these reactions, 2-deoxy-D-arabino-hexono-1,4-lactone ( $G$  in  $N_2 = 0.6$ ,  $G$  in  $N_2O = 0.8$ ), 3-deoxy-D-erythrohexosulose and other 3-deoxy sugars as deoxygenated compounds, and D-arabinohexosulose and D-xylohexos-5-ulose as dicarbonyl compounds were identified. A mechanism for the radiolysis of D-glucose in the absence of  $O_2$  is proposed. AS

## 2

**Isolation of Streptomyces having high glucose-isomerase activity and assessment of their efficiency in the production of fructose syrups.**

Joseph, R.; Shanthamma, M. S.; Sreenivasa Murthy, V.

*Journal of Food Science and Technology, India* 14 (2) 73-77 (1977) [21 ref. En] [Cent. Food Tech. Res. Inst., Mysore, India]

Strains of (i) *Streptomyces fradiae*, SCF-5 and (ii) *S. cinnamonensis*, MFS-4 capable of producing glucose isomerase were isolated from farm composts and agricultural fields. These were allowed to grow in the prescribed medium at 28-30°C for 4 days. They produced glucose isomerase ranging from 219 to 1348 units/g dry cells. The enzyme was cell bound and its activity was max. at pH 7-8 and at 60-80°C. The capacities of (i) and (ii) cell suspensions to convert glucose to fructose were tested in 20 ml of the reaction mixture. Enzyme from (i) effected greater conversion of glucose to fructose at 60°C during 24 h than (ii). The fructose syrup after decolorization, deionization and flash evaporation yielded a clear syrup with 65-70% DM content. CFTRI

## 3

**[Process technology of enzymic isomerization of glucose, and its problems.]** Prozesstechnische Probleme der enzymatischen Glucose-Isomerisierung.

Tegge, G.

*International Review for Sugar and Confectionery* 30 (4) 115-119; (5) 194, 196-199 (1977) [De] [Bundesforschungsanstalt für Getreide- & Kartoffelverarbeitung, Detmold, Federal Republic of Germany]

Enzymic isomerization of glucose present in starch hydrolysates is discussed, with reference to: economic and technical aspects; starch as a raw material, and its extraction; processes for saccharification of starch; enzymic isomerization; characteristics of glucose isomerase; technological utilization of glucose isomerase; composition of starch hydrolysates before and after enzymic isomerization; reactors for continuous isomerization; and special variants of the isomerization process (e.g. simultaneous saccharification and isomerization). AJDW

## 4

**An application of the modified hypoiodite oxidation method for the estimation of fructose:glucose ratio in honey.**

Bose, S.; Mukherjee, S.; Singh, L.

*Indian Sugar* 26 (7) 501-503 (1976) [6 ref. En] [Nat. Sugar Inst., Kanpur-208016, India]

A method is described for the analysis of glucose in a reducing sugar mixture (e.g. honey) which eliminates the rearrangement of fructose to glucose during the detn. by using  $Na_2CO_3$  instead of NaOH. 3 g honey is diluted with water to 100 ml, and a 10 ml aliquot is mixed with 75 ml 0.05M aqueous  $Na_2CO_3$  and 35 ml 0.1N iodine solution. The mixture is held at 18-20°C for 20 min in the dark, acidified with 10 ml 5N HCl and the excess iodine titrated against standard  $Na_2S_2O_3$  to determine the iodine used in oxidation of glucose to gluconic acid. Total reducing sugars may be determined by standard methods, and glucose concn. deducted to calculate glucose:fructose ratio. JRR

## 5

**[Method of obtaining glucose from cellulose-containing material.]**

Feniksova, R. V.; Kalunyants, K. A.; Vaganova, M. S.; Shchus', G. V.; Nakhapetyan, L. A.; Menyailova, I. I.; Luzhkov, A. M.; Chernova, G. A. (Union of Soviet Socialist Republics, Vsesoyuznyi Nauchno-issledovatel'skii Biokhicheskii Institut)

*USSR Patent* 562 573 (1977) [Ru]

Yield is improved by hydrolysis of cellulose to a mixture of glucose and oligosaccharides using an enzyme at 1-20 units/g cellulose, and then hydrolysing the oligosaccharides with enzyme immobilized on an insoluble carrier. W&Co

## 6

**Process for the enzymatic isomerization of dextrose to levulose.**

Armbruster, F. C.; Heady, R. E.; Cory, R. P. (CPC International Inc.)

*United States Patent Reissue* 29 152 (1977) [En]

Process is described for the production of xylose (dextrose) isomerase by means of a mutant strain of *Streptomyces* that proliferates in a culture medium that may be free of xylose. The enzyme is therefore constitutive rather than induced. IFT



## 7

[Production of medicinal glucose in a spray-drier.]  
Gulyuk, N. G.; Sidorova, E. K.; Lukin, N. D.  
*Sakharnaya Promyshlennost'* No. 9, 63-65 (1976)  
[Ru] [VNIIC, USSR]

Different procedures for purifying the initial glucose solutions are presented to find the most rational way of producing medicinal glucose. Purified syrups from the 1st product do not give higher-purity glucose even if considerable amounts of activated carbon are used. Solutions of dehydrated glucose purified with activated carbon (1.5-2.0% of DM) yield solutions of a purity corresponding to that of medicinal glucose. Spray-drying of such a solution yields a high-purity glucose preparation. STI

## 8

[The mechanism of formation of 5-hydroxymethyl-2-furaldehyde in Maillard reactions. Glucose/glycine model system.]

Barbetti, P.

*Industria Alimentari* 16 (9) 151-154 (1977) [14 ref. It] [Istituto di Chimica delle Sostanze Naturali, Univ. di Perugia, Perugia, Italy]

Studies were conducted on changes in mixtures of aqueous glucose/glycine mixtures (both constituents at a concn. of 0.06M) held at 90°C in the dark for  $\leq 144$  h in sealed flasks under a  $N_2$  atm. Samples studied contained (i) no additives, (ii) 15 p.p.m. 'Chinone-para' (a reaction-inhibiting agent) or (iii) 15 p.p.m. di-tert-butyl peroxide (a reaction-accelerating agent). Graphs of results are given, showing changes in pH, hydroxymethylfuraldehyde concn. and optical density at 285 and 400 nm. pH of (i), (ii) and (iii) decreased rapidly for the first approx. 40 h, then decreased more slowly. The hydroxymethylfuraldehyde concn. in all samples increased for the first 128 h, then decreased slightly. Optical density (at both 285 and 400 nm) of (iii) increased throughout the period studied; optical densities of (i) and (ii) increased to a max. at 128 h, then decreased considerably. Hydroxymethylfuraldehyde formation was greater in (i) than in (ii) or (iii). The mechanism of formation of hydroxymethylfuraldehyde is discussed in relation to these results. AJDW

## 9

Rapid high pressure liquid chromatographic determination of carbohydrates in milk chocolate products.

Hurst, W. J.; Martin, R. A., Jr.

*Journal of the Association of Official Analytical Chemists* 60 (5) 1180-1184 (1977) [27 ref. En] [Hershey Foods Res. Lab., PO Box 54, Hershey, Pennsylvania 17033, USA]

A high pressure liquid chromatographic method is described for determining 4 carbohydrates in milk chocolate products. The carbohydrates are extracted with water, chromatographed on a small particle packing with acetonitrile-water (80+20) mobile phase, and quantitated by a refractive index

detector and digital integrator. The relationship between peak area and concn. was linear. Retention times and peak areas were reproducible. This procedure was successfully applied to several milk chocolate samples and is rapid and more accurate and precise than the official methods. Recoveries of sucrose, glucose, fructose and lactose added to milk chocolate samples were 97.4, 97.0, 102.5 and 97.0%, resp. AS

## 10

[Automatic control of the output of evaporators during the production of glucose.]

Ladanyuk, A. P.; Sasin, N. D.

*Sakharnaya Promyshlennost'* No. 3, 60-63 (1977) [2 ref. Ru] [KTIPP, USSR]

A method for control of the operating conditions of evaporators was developed at the Verkhnedneprovsk plant; in addition to pressure control, the concn. of syrup can also be controlled by changing the vol. of syrup leaving the last evaporator body. Automation ensures a uniform output when the initial quantity of syrup is changed. When the amount of syrup entering is less than the nominal quantity, minimal steam pressure is also maintained. When syrup quantity is increased, steam pressure is also increased, which increases the boiling temp. in the 1st evaporatory body (approx. to 110°C). Thus the syrup retention period is also reduced and undesirable darkening prevented. The temp. change is sufficiently rapid; 2 to 2.5 min after the pressure change the new boiling temp. is stabilized. This arrangement increases the output of the evaporator and accelerates the passage of the syrup. STI

## 11

Process of refining enzymatically produced levulose syrups.

Walton, R. G. P. (CPC International Inc.)

*United States Patent* 4 040 861 (1977) [En]

Enzymically produced 1-glucose-bearing syrup is subjected to treatment with a cation exchanger and an anion exchanger for removal of ions and to sulphonated coal for decolorization. A syrup of exceptional purity and stability is produced. IFT

## 12

[Colorimetric determination of reducing sugars using o-nitrobenzoic acid.]

Teodorczyk, M.; Soloniewicz, R.

*Chemia Analityczna* 22 (1) 151-154 (1977) [9 ref. Pl, en] [Inst. Chem. Ogolnej, Politech., Lodz, Poland]

A method of colorimetric detn. of mg amounts of glucose and fructose by means of alkaline solutions of o-nitrobenzoic acid has been developed. Best results were obtained when the concn. of KOH in the final solution was 0.25M and a 20% solution of sodium-potassium tartrate was added to reduce the destructive action of  $O_2$ . The colour was developed in a water bath at 70°C for 30 min. The absorbance was measured at 410 nm. AS



## 13

[High-fructose glucose syrups: a new ingredient in liqueur chocolate manufacture.]

Pollet, B.

*Revue des Fabricants de Confiserie, Chocolaterie, Confiturerie, Biscuiterie* 52 (6) 13-17 (1977) [Fr]  
[G. R. Amyluun NV, Belgium]

The utilization of high-fructose glucose syrup for liqueur chocolate manufacture is briefly discussed including 2 suitable types (Isosweet and Sir-O-Sweet 2080), liqueur preparation, and advantages over traditional syrups (shorter and simpler manufacture). RM

## 14

[Glucose derived from potatoes and maize.]

Romania, Institutul Roman de Standardizare  
*Romanian Standard STAS 9-75*, 18pp. (1975)  
[Ro] [Strada Edgar Quinet nr. 6, Bucharest, Romania]

This standard for glucose produced by acid hydrolysis of potato or corn starch, which replaces the standard of the same number published in 1957, covers the following aspects: required quality of raw materials and processing agents; quality requirements for liquid glucose and for flavoured and non-flavoured solid glucose (i.e. colour, appearance, flavour, aroma, foreign matter, acidity, moisture content, glucose content, free mineral acid content, and concn. of Pb, Cu and As); sampling; testing and analysis; packaging; labelling; storage; transport; and min. duration of guarantee.

AJDW

## 15

[Isomerized grape sugar.]

Nippon Food Chemicals Co. Ltd.

*Japanese Patent* 5 227 698 (1977) [Ja]

A process is described for the isomerization of grape sugar solutions to fruit sugar to which is added waxy starch hydrolysates to reduce the tendency to crystallize. IFT

## 16

[Are sugar cane and sugar beet superannuated?]

Haben Zuckerrohr und Zuckerrübe ausgedient?  
Tegge, G.

*Umschau in Wissenschaft und Technik* 77 (19)  
641-642 (1977) [De] [Bundesforschungsanstalt  
für Getreide & Kartoffelverarbeitung, Detmold,  
Federal Republic of Germany]

Manufacture of high-fructose starch hydrolysates by enzymic isomerization of glucose (using microbial glucose isomerases) is described; commercial products (isosyrups) contain approx. 50% glucose, 42% fructose and 8% oligosaccharides. The potential for utilization of immobilized glucose isomerase is also considered. The high-fructose starch hydrolysate is comparable to invert sugar manufactured from sucrose. A major advantage of starch hydrolysates is the potential for prolonged storage of the raw material, and consequent

operation of equipment all the year, as compared to the relatively brief processing campaigns which are possible in the beet and cane sugar industries.

AJDW

## 17

Performance of the continuous glucose isomerase reactor system for the production of fructose syrup.

Ryu, D. Y.; Chung, S. H.; Katoh, K.

*Biotechnology and Bioengineering* 19 (2) 159-184  
(1977) [42 ref. En] [Dep. of Biol. Sci. & Eng.,  
Korea Advanced Inst. of Sci., PO Box 150,  
Chongyangni, Seoul, Korea]

The performance of a plug-flow continuous enzyme reactor system employing glucose isomerase from *Streptomyces phaeochromogenus* was studied experimentally and simulated on a computer for optimization purposes. The simulation was in good agreement with experimental observations, and can be used to predict performance of the reactor. The reaction kinetics of glucose isomerase, the enzyme loading and changes of reaction rate were found to be of particular importance. JRR

## 18

[Processes for glucose isomerization.] Verfahren zur Isomerisierung von Glucose.

Anon.

*Zeitschrift für die Zuckerindustrie* 27 (11) 730-732 (1977) [De]

Enzymic processes of glucose isomerization subject to recent US patents are briefly discussed in the following sections: production of glucose isomerase, isomerization, enzymic transformation of starch and starch syrups, and production and application of immobilized isomerase. 28 patents are held by 7 USA, 1 Danish and 1 Japanese firm. RM

## 19

[Dehydration characteristics of drops of fluid products in starch production.]

Kosmodem'yanskii, I. V.; Lukin, N. D.;

Mikhailenko, A. A.; Chilikina, N. V.

*Sakharnaya Promyshlennost'* No. 4, 57-62 (1977)  
[4 ref. Ru] [MTIMMP, USSR]

Changes in the diam. of drops of solutions of starch syrup, glucose syrup, glucose, maize extract and potato hydrolysate, together with mass transfer and heat transfer during spray drying were studied. The drops entered the drier when the temp. of the drying medium was 323-463°K. The dehydration velocity curves of the maize extract and starch syrup extracts are characteristic of those for complicated colloid-capillary-porous media. Due to the small size of the droplets and to the hydrodynamic drying process the final moisture content ranges between 2 and 6% at comparatively low drying temp. of 360-380°K. STI



## 20

[Highly-saccharified and fructose-containing glucose syrups in gum-type confectionery.]

Hochverzuckerte und fruktosehaltige Glukosesirupe in Gummisüßwaren.

Völker, H. H.

*Süßwaren* 21 (17) 522, 524-526 (1977) [De]

Use of (i) fructose-containing (isomerized) and (ii) high-glucose high-maltose glucose syrups as replacement for normal glucose syrups in manufacture of gum confectionery was studied. Data are given for: the d.e. value, pH, ash content, colour, SO<sub>2</sub>-content and carbohydrate composition of the syrups; the recipes of the products manufactured; the composition of the other ingredients used; and the sugar composition, processing characteristics, clarity, consistency, sweetness, flavour and colour of the confectionery produced. The dependence of hygroscopicity on syrup type was evaluated during a 14-day storage trial. The results show that substitution of (ii) for normal glucose syrup had little effect on gum characteristics except for a slight increase in water uptake, and a slight decrease in gel firmness. Substitution of (i) for normal glucose syrup increased the hygroscopicity and decreased the consistency value of gum confectionery. IN

## 21

Hunger in humans induced by 2-deoxy-D-glucose: glucoprivic control of taste preference and food intake.

Thompson, D. A.; Campbell, R. G.

*Science, USA* 198 (4321) 1065-1068 (1977) [39 ref. En] [Monroe Community Hospital, Rochester, New York 14603, USA]

Intracellular glucopenia induced by 2-deoxy-D-glucose (2DG) administration in man produced increased hunger ratings and magnitude estimates of pleasantness for sucrose solutions. Augmented food intake substantiated these changes in affective behaviour and relieved experimentally induced hunger. Intracellular glucopenia activated counterregulatory mechanisms to raise plasma glucose concn. Inducing hunger experimentally with 2DG should provide a useful method for studying appetitive behaviour in humans. AS

## 22

Developments in brewing syrups.

Smith, J. B.

*Brewer* 63 (748) 50-55 (1977) [15 ref. En]

Recent brewing syrup products and techniques for their use are reviewed, with reference to the enzymic production of glucose syrups, and of low-glucose (3%), high-maltose (55%) syrup; isomerization for the production of high-fructose syrup; and future developments expected in these areas. The use of syrups in batch and tower fermenters, and in high gravity brewing is discussed, and also the adjunct brewing process, in which all-malt and syrup worts are fermented separately and blended as bright beer. In adjunct brewing, high

maltose syrups produce an unacceptably high concn. of volatiles; therefore a 40% glucose, 30% maltose, 5% maltotriose syrup is employed. JRR

## 23

[Production of high-fructose glucose syrups (HFGS).]

Hauss, S. de

*Industries Alimentaires et Agricoles* 94 (9/10) 991-995 (1977) [Fr, de, en]

The author discusses the characteristics, usefulness, properties and applications of high fructose glucose syrup (HFGS) and gives a brief outline of its industrial production. 70.4% HFGS can be obtained from maize with consumptions/t dry maize of 8 m<sup>3</sup> water, 0.23 t fuel, and 270 kWh electricity. Cassava and potatoes can yield 68% and 73.5% HFGS, resp. Investment and production costs and returns for HFGS are compared with those for sugar production. RM

## 24

Production and physicochemical properties of hydrogenated glucose syrups.

Kearsley, M. W.; Birch, G. G.

*Stärke* 29 (12) 425-429 (1977) [33 ref. En, de, fr] [Nat. Coll. of Food Tech., St. George's Avenue, Weybridge, Surrey, UK]

The production of some hydrogenated glucose syrups and properties of the products were studied. The commercial method of sorbitol production using high pressure hydrogenation (100 atm at 100°C) with Raney Nickel catalyst was used. The rate of reduction and extent of fall in the d.e. value, and the d.e. reduction vs. time during hydrogenation is shown graphically. The glucose syrups were found to be partially hydrogenated fairly easily, but reduction to zero % d.e. may be difficult: the initial rapid fall in d.e. value levelled off after 1 h. Whilst no significant differences were observed in osmotic pressure, viscosity and threshold sweetness concn. before and after hydrogenation, useful physiological differences are expected. Reduction to zero % d.e. may be necessary for differences to become apparent. RM

## 25

Process for producing fructose and syrups containing fructose and glucose, and means for carrying out the process.

Snamprogetti Spa

*British Patent* 1 457 177 (1976) [En]

Microorganisms of the genus *Bacillus* are cultivated under aerobic conditions at 45-70°C in a culture medium containing inorganic salts and assimilable sources of C and N to produce glucose isomerase in the cells. The enzyme is used for inverting glucose to fructose. GL



## 26

[High-invert liquid sugars.] Über invertzuckerreiche Flüssigzucker. Vukov, K.; Patkai, G.; Monszpárt-Senyi, J. *Zeitschrift für die Zuckerindustrie* 27 (12) 792-795 (1977) [28 ref. De, en, fr, es] [Kerteszeti Egyetem Tartosítóipari Kar. Konzervipari Tech. Tanszék Csoport, POB 53, H-1502 Budapest, Hungary]

The production of high-fructose syrups from sugar millet (*Sorghum saccharatum*), date syrup and isoglucose is described. Properties of these syrups (chemical composition, heat resistance, cold resistance, microbiological properties, viscosity and sweetening power) are discussed with the aid of tabulated data. It is suggested that date and isoglucose syrup can be used for virtually all purposes requiring liquid invert sugars, provided their special properties are considered. RM

## 27

Specification for dextrose monohydrate. India, Indian Standards Institution *Indian Standard IS:874-1975*, 15pp. (1975) [En] Price Rs7.00 [Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002, India]

The standard prescribes requirements and methods of sampling and test for dextrose monohydrate suitable for use in the food preserving industry. Important modifications in this revision of the original 1956 standard are a change in the limit for As to  $\leq 1.1$  p.p.m., substitution of separate requirements for Pb ( $\leq 0.5$  p.p.m.) and Cu ( $\leq 2$  p.p.m.) in place of heavy metals, and deletion of the requirements for chloride, sulphates, less-soluble sugars, solubility and dextrin. AL

## 28

Interaction of pyridoxal and pyridoxal phosphate with peptides in a model food system during thermal processing.

Gregory, J. F.; Kirk, J. R. *Journal of Food Science* 42 (6) 1554-1557, 1561 (1977) [37 ref. En] [Dep. of Food Sci. & Human Nutr., Michigan State Univ., E. Lansing, Michigan 48824, USA]

A soluble model system was utilized to study the interactions of pyridoxal (PL) and pyridoxal phosphate (PLP) with proteins during the thermal processing of foods. Heat stable peptides, rather than intact proteins, were used in the model system to maintain solubility and permit subsequent evaluation of the peptide binding of the vitamin B<sub>6</sub> complex. UV and visible difference spectra and fluorescence emission spectra confirmed THE BINDING OF PL and PLP to the peptides during processing. Total peptide-bound PLP (as the sum of Schiff base, pyridoxylamino, and substituted aldamine derivatives) comprised about 21% of the model system PLP. Approx. 60% of the peptide-bound PLP was bound via nonreducible linkages, suggesting the possible formation of biologically

unavailable pyridoxylamino complexes. The acid stability of the PLP complexes, tested to simulate gastric conditions, indicated that most of the nonreducible bound PLP was in the form of pyridoxylamino complexes. Therefore, approx. 10% of the model system PLP was rendered biologically unavailable during these process conditions. The presence of ascorbic acid and/or glucose in the model systems had no significant effect on the extent or manner of peptide-binding of the vitamin B<sub>6</sub> complex; however, glucose-induced browning appeared to slightly inhibit pyridoxylamino complex formation. The results of this study indicate that losses of vitamin B<sub>6</sub> bioavailability during thermal processing may be lower than previously reported. IFT

## 29

[Desulphitation of fruit juices. VII. Study of SO<sub>2</sub>-glucose reaction in sulphited orange juice.]

Benedito, J.; Escardino, A.; Vega, A. *Revista de Agroquímica y Tecnología de Alimentos* 17 (3) 343-352 (1977) [11 ref. Es, en] [Inst. de Agroquímica y Tecnología de Alimentos, Valencia, Spain]

A technique and apparatus are described for simultaneous detn. of the apparent rate and equilibrium constants for the SO<sub>2</sub>-glucose reaction in sulphited orange juice. The accuracy of this technique was satisfactory (s.d.  $8 \times 10^{-5}$ ,  $8 \times 10^{-5}$ ,  $4 \times 10^{-2}$  for apparent addition and decomposition rate constants  $k$  and  $k'$  and equilibrium constant  $K_c$ , resp.). Results, shown graphically and in tables, indicated that at temp. generally used in industrial processing the constants differ significantly from those calculated for model glucose solutions: at 100°C and pH 3.0, apparent constants for orange juice (17° Brix) and model solutions (0.202M) were  $k = 0.48$  and  $1.00/\text{mol min}$ ,  $k' = 1.36$  and  $2.87/\text{mol min}$ , and  $K_c = 0.35$  and  $0.27/\text{mol min}$ , resp. Differences were also found between the apparent activation energies for addition and decomposition  $E_a$  and  $E'_a$ , and apparent mean reaction heat  $\Delta H$  at 5-40°C between orange juice and model solutions:  $E_a = 56.96$  and  $64.91 \text{ J/mol}$ ,  $E'_a = 70.61$  and  $81.04 \text{ J/mol}$  and  $\Delta H = -13.65$  and  $-15.99 \text{ J/mol}$ . [See preceding abstr. for part VI.] RM

## 30

A note on the physical and chemical composition of tender coconut water.

Subramanian, T. L.; Vasudevan, P. *Madras Agricultural Journal* 64 (9) 616-617 (1977) [1 ref. En] [Dep. of Soil Sci. & Agric. Chem., Tamil Nadu Agric. Univ., Coimbatore-3, Tamil Nadu, India]

The pH, sp. gr., acidity, and chloride and sugar contents (reducing, non-reducing, and total) of 19 samples of tender coconut water were determined



and the % glucose ratio was calculated. 14 samples were sweet in taste, and 5 salty, the latter having a high content of chloride and a high glucose ratio. CFTRI

### 31

#### Improved encapsulated citrus oils.

Crocker, D. C.; Pritchett, D. E.

*Food Technology* 32 (1) 36, 38-39 (1978) [8 ref. En] [Sunkist Growers, Inc., Sunkist Res. Cent., 760 E. Sunkist Street, Ontario, California 91761, USA]

The original matrix used for encapsulating citrus oils consisted of molten corn syrup solids and glycerine with a suitable emulsifier. Modification of this matrix by using corn syrup with a dextrose equivalent of 20 (instead of 42), omission of glycerine and introduction of sucrose, produced a less hygroscopic product. Evaluation of the modified product by a sensory panel showed no significant differences in oil flavour quality between samples stored at 4 or 38°C for > 1 yr, whereas citrus oil stored as a liquid and exposed to O<sub>2</sub> began to deteriorate after 1 wk. MEG

### 32

#### [Legal and technical aspects of using dextrose in chocolate manufacture.]

Pelgroms, J.

*Revue des Fabricants de Confiserie, Chocolaterie, Confiturerie, Biscuiterie* 52 (12) 12-17 (1977) [Fr] [G.R. Amylum, Aalst, Belgium]

This article discusses national and EEC (Council directive of the 24.3.1973) regulation of dextrose in chocolate manufacture, the technical reasons for its use, purity standards for monohydrate, anhydrous and dehydrated dextrose, manufacturing conditions and parameters (formulae, choice of cocoa beans and roasting, cocoa beans breaking and grinding, sugar grinding, kneading, refining, conching, tempering), and results (chocolate analysis - moisture content, sensory properties, shelf life). In view of its low sweetening effect, enhancement of chocolate flavour and fine crystal size, abolition of the 20% upper limit of use is supported. RM

### 33

#### Solid anhydrous dextrose.

Schollmeier, C. E.; Leiser, R. S. (A. E. Staley Manufacturing Co.)

*United States Patent* 4 059 460 (1977) [En]

A solid, essentially free-flowing and non-compacting anhydrous dextrose conversion syrup product is produced from a dextrose conversion syrup with a dextrose content of > 93%. The anhydrous dextrose particles may be used as a sugar or dextrose monohydrate replacement. IFT

### 34

#### The future for corn wet milling.

Casey, J. P.

*Food Technology* 32 (1) 72-74 (1978) [4 ref. En]

[1521 Dogwood Drive, Elkhart, Indiana 46514, USA]

Variations in the consumption of corn syrup and starch since 1940 are discussed and the importance to the corn wet milling industry of the development of high-fructose corn syrups is outlined. Production of new types of starch derivatives for use as low cost stabilizers and thickeners in the food industry is also mentioned. MEG

### 35

#### Action of cellulases from fungus of marine origin on rice straw.

Souza, J. de; Furtado, I.

*Indian Journal of Microbiology* 17 (4) 194-197 (1977) [20 ref. En] [Cent. of Post-graduate Instruction & Res., Univ. of Bombay, Panaji, Goa]

The action of a marine fungus, *Aspergillus terreus*, on pre-treated (4% NaOH and steaming for 30 min) rice straw was studied on *Trichoderma viride* medium from 4 to 28 days. Cellulase activity was max. on the 7th day when 625-635 µg/ml 2 h of reducing sugars were produced. Enzyme saccharification of delignified straw proceeds faster than the untreated straw. The cellulases were precipitated from the crude filtrate by chilled acetone. 1 µg/ml of the enzyme protein could produce 1.6 µg/ml of reducing sugars (mainly glucose and cellobiose) in about 2 h. Thus, rice straw can be converted into a nutritive feed for livestock or as a starting material for the production of glucose syrup, alcohol and acids. CFTRI

### 36

#### [The reactivity of glucose and fructose in the carbonyl-amino reaction in technical sugar juices.]

Über die Reaktivität von Glucose und Fructose bei der Carbonylamino-Reaktion in technischen Zuckersäften.

Reinefeld, E.; Bliesener, K.-M.; Kunz, M.

*Zuckerindustrie* 103 (1) 20-28 (1978) [28 ref. De, en, es, fr] [Inst. für Landwirtschaftliche Tech. & Zuckerind. der TU Braunschweig, Langer Kamp 5, D-3300 Braunschweig, Federal Republic of Germany]

The higher content of glucose than fructose in technical sucrose solutions before crystallization while fructose predominates in crystallization run-offs is explained. In a weakly alkaline aqueous medium (thin and thick juices) reactive carbonyl compounds such as glyceraldehyde, methyl glyoxal and deoxyhexosuloses are first formed from the invert sugar components, some then react with the amino acids always present in technical solutions to form melanoidins, while others are rearranged to their corresponding lactic and saccharinic acids. These reactive intermediate products are formed more rapidly from fructose than from glucose, hence fructose is the more reactive component. Run-offs from crystallization contain the same potential reaction partners but hold little water. Under these conditions, the monosaccharides react (without forming the more reactive intermediate



compounds) with the amino acids by condensation and subsequent Amadori or Heyns rearrangement to hexose amino acids. In this reaction sequence, glucose is converted more rapidly than fructose. Because the invert sugar components follow different reaction paths (despite the same reaction partners and the same pH) as a function of the water content of the medium, different glucose:fructose ratios result. AS

### 37

**Effects of temperature and concentration on the relative sweetness of fructose, glucose and xylitol.** Hyvönen, L.; Kurkela, R.; Koivistoinen, P.; Merimaa, P.

*Lebensmittel-Wissenschaft und -Technologie* 10 (6) 316-320 (1977) [20 ref. En] [Dep. of Food Chem. & Tech., Univ. of Helsinki, SF-00710 Helsinki 71, Finland]

The effect of temp. on the sweetness of sucrose and on the relative sweetness of fructose, glucose and xylitol compared to 5, 10 and 20% sucrose references was determined by an experienced taste panel using a forced-choice paired comparison method. The effect of concn. on the relative sweetness of the sweeteners was also estimated. The sweetness of sucrose was about 10% lower at refrigerator temp. (5°C) and about 10% higher at 50°C as compared to the sweetness at 22°C. Temp. had a noticeable influence on the relative sweetness of fructose. The effect of concn. was not significant. The relative sweetness of glucose differed only slightly with the temp., but the relative sweetness of glucose at the higher concn. was significantly greater than at the lower concn. At 5° and 22°C the sweetness of xylitol at lower concn. was near that of sucrose. At the higher temp. (37° and 50°C) the relative sweetness of xylitol was somewhat less. The relative sweetness of xylitol was also greater at higher concn. than at the 5% level at every temp. studied. AS

### 38

[Fructose production.]

Tanabe Seiyaku Co. Ltd.

*Japanese Patent* 5 247 036 (1977) [Ja]

Process for converting glucose to fructose uses a glucose isomerase-forming microorganism which has been immobilized in an acrylic polymer. IFT

### 39

**Continuous polarimetry in enzymatic gluconic acid production.**

Möller, K. G.; Wandrey, C.

*European Journal of Applied Microbiology* 3 (2) 81-89 (1976) [5 ref. En] [Inst. für Tech. Chem., Tech. Univ. Hannover, Callinstrasse 46, D-3000 Hanover, Federal Republic of Germany]

A continuous polarimetric analytical method was applied to the enzymatic conversion of glucose to gluconic acid. In this case a simple polarimetric analysis is only possible by setting the pH to 10. Because the pH optimum of the reaction is at pH 6

this is carried out in the outlet of a continuous reactor before the product stream reaches the flow through the cuvette of the polarimeter. The variability coeff. of the polarimetric method is 0.8% in comparison to 1.6% of the classical photometric method. The high precision and the high time resolution of the polarimetric method makes it applicable to continuous operation. AS

### 40

**[Isotopic  $^{13}\text{C}/^{12}\text{C}$  composition of sucrose and glucose of different origins and authenticity control of maple syrups and sugars.]**

Hillaire-Marcel, C.; Carro-Jost, O.; Jacob, C.

*Canadian Institute of Food Science and Technology Journal* 10 (4) 333-335 (1977) [14 ref. Fr] [Dep. des Sci. de la Terre, Cent. de Recherches en Sci. Appliquées à l'Alimentation, Univ. du Québec, Montreal, Quebec, Canada]

(i) 3 samples of cane sugar of different origin and (ii) 3 of beet sugar of different campaigns, (iii) 5 samples of Quebec maple syrups, (iv) 5 of Vermont maple syrups, (v) 1 of maple sugar, and (vi) 1 of maize syrup and also of laboratory mixtures of maple and cane sugars were analysed for  $^{13}\text{C}/^{12}\text{C}$  ratios by MS. Individual values for relative % differences between sample  $^{13}\text{C}/^{12}\text{C}$  ratio and that of PDB international standard (i.e.  $\text{CO}_2$  from cretaceous belemnite) are tabulated, values of Bricout & Fontes [FSTA (1975) 7 9L811] being quoted for comparison. Mean values for (i)-(vi) were, resp. (%): -1.147, -2.595, -2.354, -2.392, -2.271 and -1.039. It is concluded that the method enables detection of > 10% addition of cane sugar or maize syrups to maple syrups, and of > 50% of beet sugar to maple sugar; and that only 20-50 mg of sample are required for analysis. SKK

### 41

**Preparation of glucose and high fructose syrups from bananas (*Musa cavendishii*).**

Wyk, P. J. van; Heinen, E. A.; Ackermann, L. G. J.

*Lebensmittel-Wissenschaft und -Technologie* 11 (1) 29-30 (1978) [11 ref. En] [Nat. Food Res.

Inst., South African Council for Sci. & Ind. Res., PO Box 395, Pretoria 0001, South Africa]

Production of glucose and fructose syrups from bananas by a method similar to that used with corn starch was investigated. The following conditions were studied: (i) green unpeeled bananas were comminuted and pulped,  $\alpha$ -amylase was added, the pulp was heated to 85°C in a heat exchanger, then cooled to 55°C and the pH adjusted to 4 and treated with amyloglucosidase and saccharified at 55°C for 24 h; treated pulp was clarified, filtered and concentrated to a syrup; (ii) firm ripe peeled bananas were similarly treated; (iii) firm ripe unpeeled bananas were similarly treated; and (iv) overripe peeled bananas were given the same treatment, without the 2 enzymes, but pectinase was added before clarification. Soft ripe bananas were also studied, but gave a jelly-like product despite the use of pectinase. Properties of the



resulting syrups from (i)-(iv) resp. were: °Brix 75, 74, 80 and 70; moisture content 22.4, 27.5, 21.5 and 32.8 g/100 g; glucose content 75.9, 29.8, 21.5 and 26.6 g/100 g; fructose content 0, 23.7, 25.1 and 36.5 g/100 g; and sucrose content 0, 18.1, 30.8 and 0. Yields were 8.5, 10.8, 10.0 and 6.2%, resp., dry basis. (i) and (iv) contained almost entirely monosaccharides. DIH

## 42

### The sweetness of glucose syrups.

Kearsley, M. W.; Birch, G. G.; Dziedzic, S. Z. *Lebensmittel-Wissenschaft und -Technologie* 11 (1) 23-25 (1978) [21 ref. En] [Nat. Coll. of Food Tech., Univ. of Reading, St. George's Avenue, Weybridge, Surrey, UK]

Details regarding the hitherto little investigated subject of threshold sweetness concn. of glucose syrups are presented in an attempt to establish an absolute sweetness value for these carbohydrates. A linear relationship is found between threshold concn. and DE and between threshold concn. and average mol. wt. Synergistic sweetening effects are shown to occur in the low DE syrups. The threshold sweetness values of a series of hydrogenated glucose syrups are measured and compared statistically with the threshold values for the unmodified parent syrup. No significant differences are found between the 2 series, indicating that modification of the hemiacetal hydroxyl group of the anomeric C atom in the terminal glucose residue of each oligosaccharide (by hydrogenation to an alcohol group) does not change the threshold sweetness of a glucose syrup. AS

## 43

The relative sweetness of fructose, glucose and xylitol in acid solutions at different temperatures. Hyvönen, L.; Kurkela, R.; Koivistoinen, P.; Ala-Kulju, M.-L.

*Lebensmittel-Wissenschaft und -Technologie* 11 (1) 11-14 (1978) [9 ref. En] [Dep. of Food Chem. & Tech., Univ. of Helsinki, 00710 Helsinki 71, Finland]

Relative sweetness (RS) of the sugars was determined in 10% solutions at 6°, 23° or 50°C in the presence or absence of citric, malic or phosphoric acid (CA, MA, PA, resp.), each used at 2 concn. Results are expressed in terms of sweetness relative to a 10% sucrose solution under the same conditions of temp. and acidity. RS values of fructose, glucose, and xylitol at 6°C, no acid, were 117, 70 and 103, resp.; values were similar at 23°C, but were depressed at 50°C, to 93, 64 and 80, resp. Low concn. of CA, MA and PA (0.01, 0.007 and 0.0035%, resp.) significantly increased RS values of fructose at 6°; acid had no effect on RS of fructose at 23°C; and at 50°C, CA at 0.01 and 0.05%, MA at 0.035% and PA at 0.0035% decreased RS of fructose. Glucose and xylitol were not greatly affected by acid, except that at 50°C, RS of xylitol was  $87 \pm 1$  with 0.0175% PA vs.  $80 \pm 2$  with no acid, and at 6°C, RS of xylitol was significantly decreased by 0.0175% PA. The slight effects of acid on glucose RS were always decreases. DIH

## 44

[Shop-floor experience with the manufacture of crystalline glucose by acid/enzyme hydrolysis of starch.]

Ladur, T. A.; Gulyuk, N. G.; Borodina, Z. M.; Pikhalo, D. M.; Bondar', E. G.; Shornikov, V. G.; Malyi, G. D.

*Sakharnaya Promyshlennost'* No. 11, 71-74 (1977) [3 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

The experiments were carried out with starch suspensions (37-40% concn., 40°C) initially hydrolysed with HCl used at 0.1% of starch DM wt. until hydrolysates containing 12-22% reducing substances were obtained. The acidic syrup was adjusted to pH 4.0-4.5 with Na<sub>2</sub>CO<sub>3</sub> solution, and slowly cooled to 60°C. The saccharification was induced by glucoamylase (gluconigrin G 20 x) with a glucoamylase activity of 1300 units/g preparation, which was dosed at 0.1-0.2% of starch DM. Hydrolysis time depends on the dosage of the preparation; with 0.2% glucoamylase it is 48 h; with 0.15%, 60 h and with 0.1%, 80 h. The combined method gives quality hydrolysates with 95.5-96.3% purity. The glucose crystallization time is reduced to 48-56 h in the I product, and to 96 h in the II product. The quality of crystalline glucose is better than that of glucose obtained by acid hydrolysis alone. STI

## 45

Filter aids, production and applications.

Pinto, T.

*Brewer* 63 (750) 121-126 (1977) [En]

The production of diatomite and perlite filter aids is briefly outlined, and some applications are described, including production of glucose syrup, cider filtration and reclamation of frying fats. JRR

## 46

Fructose preparation.

L. Givaudan & Cie SA

*British Patent* 1 496 309 (1977) [En]

Fructose is prepared by the isomerization of glucose using a *Streptomyces glaucescens* mutant with no tyrosinase activity. IFT

## 47

Dextrose production.

Muller, H.

*British Patent* 1 495 220 (1977) [En]

Dextrose and dextrans are produced from protein-containing starch materials by acid or enzymic hydrolysis with separation by ultrafiltration. IFT

## 48

[High-fructose glucose syrup.] Über hochfructosehaltigen Glukosesirup. Benk, E.

*0762db* 28 (3/4) 86-87 (1978) [7 ref. De]

[Sonnenhalde 6, D-7480 Sigmaringen, Federal Republic of Germany]



The production; physical chemical and microbiological properties; possible uses; and legal evaluation of high fructose glucose syrup (isoglucose syrup) is reviewed on the basis of published data and the author's experience. RM

## 49

Contribution to the study of aroma retention in foodstuffs.

Audu, T. O. K.; Loncin, M.

*Lebensmittel-Wissenschaft und -Technologie* 11 (3) 131-133 (1978) [13 ref. En] [Dep. of Chem. and Petroleum Eng., Univ. of Benin, Nigeria]

Aroma retention during spray-drying of foods was studied by drying droplets of sugar solutions containing  $^{14}\text{C}$ -acetone as a model aroma compound. 1- $\mu\text{l}$  droplets were dried on a thermocouple in an oven; size of the droplets during drying was recorded photographically. Drying curves (droplet diam.<sup>3</sup> vs. drying time, both expressed as dimensionless numbers) for glucose solutions (10, 20 and 50%), glucose + lactose (10% + 10%), glucose + fructose (10% + 10%) and glucose + corn syrup solids (10% + 10%) at 30° or 70° C are given. 50% glucose and glucose + corn syrup solids solutions behaved anomalously, showing improved drying characteristics at 30° C as compared to 70° C. Average retention of  $^{14}\text{C}$  for all solutions after drying was, at 30° C, 55.4%, compared with 68.2% at 70° C. Contrary to expectation, presence of lactose did not apparently affect  $^{14}\text{C}$  retention. DIH

## 50

Immobilization of *Aspergillus* beta-glucosidase on chitosan.

Bissett, F.; Sternberg, D.

*Applied and Environmental Microbiology* 35 (4) 750-755 (1978) [15 ref. En] [Food Sci. Lab., US Army Natick Res. & Development Command, Natick, Massachusetts 01760, USA]

$\beta$ -glucosidase of *A. phoenicis* QM 329 was immobilized on chitosan by glutaraldehyde. The most active preparation contained a 1:2.5 ratio of enzyme/chitosan. However, specific activity of the bound enzyme decreased from 10 to 1% with increasing enzyme/chitosan ratio. Compared with free  $\beta$ -glucosidase, the immobilized enzyme showed a similar pH optimum but more activity at lower pH values, improved thermal stability, similar response to inhibition by glucose, and mass transfer limitations. The reason for investigating immobilized  $\beta$ -glucosidase was to assess its potential usefulness in the saccharification of cellulose with *Trichoderma* cellulase enzymes to produce glucose syrup. AL

## 51

Practical process conditions for the use of immobilized glucose isomerase.

Hupkes, J. V.

*Stärke* 30 (1) 24-28 (1978) [5 ref. En, de] [Gist-Brocades NV, Postbus 1, Delft, Netherlands]

Practical process conditions are described for continuous glucose isomerization in a fixed-bed column by the immobilized enzyme preparation Maxazyme GI-Immobil., i.e. pH, temp., concn. of activators, quality of substrate, enzyme bed dimensions. Special attention is paid to compressibility of the enzyme particles and the characteristic pressure drop. Improvements are described for producing the immobilized enzyme for use in columns up to 5 m bed height. Characteristics of Maxazyme GI-Immobil., reaction conditions, operating conditions for activity detn., flow and pressure drop figures for bed heights 3-5 m, productivity figures and characteristics of the product (high fructose corn syrup) are shown in tables, with a flow sheet for enzyme production, in a fixed-bed reactor, with permeability and compressibility data. [See also FSTA (1977) 9 3L273.] RM

## 52

Preparation of macro quantities of glucose oligomers.

Dziedzic, S.; Kearsley, M. W.

*Journal of Chromatography* 154 (2) 295-296 (1978) [En] [Nat. Coll. of Food Tech., Univ. of Reading, St George's Avenue, Weybridge, Surrey, UK]

A method is described whereby macro quantities of glucose oligomers from maltotriose to maltopentaose can be produced by fractionation of the acetate esters of the glucose syrup. The method can easily be extended to include the separation of higher saccharides if desired. AL

## 53

[Process for use of an enzyme to transform, by enzymic reaction, one organic substance into at least one other organic substance.]

Schneider, M. (Switzerland, Battelle Memorial Institute)

*Swiss Patent* 596 313 (1978) [Fr]

To effect the transformation, the enzyme is fixed by covalent bonds to a polymer soluble in water, and the aqueous solution is added to an aqueous solution of the substance to be transformed. By this means starch can be converted to glucose after a dwell time of 12 h at 60° C and pH 5; or glucose to fructose, or lactose to galactose and glucose. The preferred soluble polymer is a polyacrylic azide. This can be removed from the reaction solution by precipitation after the enzymic change has occurred. W&Co

## 54

Depletion of glucose in Egyptian egg white before dehydration.

Shehab, S. K.; Darwish, N. M.; Sadek, M. A.

*Nahrung* 22 (1) 3-9 (1978) [13 ref. En, de, ru] [Dep. of Nutr. & Food Chem., Coll. of Women, Ain Shams Univ., Heliopolis, Cairo, Egypt]

Studies were conducted on removal of glucose from egg white by (i) fermentation with



*Streptococcus lactis*, (ii) fermentation with *Aerobacter aerogenes*, (iii) fermentation with *Saccharomyces cerevisiae*, or (iv) enzymic oxidation using a fungal glucose oxidase preparation (containing catalase). Effects of added yeast extract on the efficiency of glucose elimination by microbial fermentation were also studied. Tables and graphs of results are given. (i) fully eliminated glucose in 9 h at pH 6.0 and 30°C if 0.2% yeast extract was added; without added yeast extract, only partial elimination of glucose was achieved. Fermentation by (i) resulted in objectionable changes in odour and appearance of the egg white. (ii) fully eliminated glucose during fermentation at pH 7.0 and 37°C for 3-4 h. (iii) fully eliminated glucose in 9 h at pH 6.0-7.5 and 32°C in the presence of 0.2% yeast extract. (iv) gave complete elimination of glucose if glucose oxidase was added at 3.8 units/100 ml egg white, and the mixture was held for 8 h at pH 7.3 and 14.5°C. (ii), (iii) and (iv) did not adversely affect the odour or appearance of the product. AJDW

## 55

Technological evaluation of dried egg white prepared by different techniques.

Darwish, N. M.; Sadek, M. A.

*Nahrung* 22 (1) 11-17 (1978) [12 ref. En, de, ru] [Dep. of Nutr. & Food Chem., Coll. of Women, Ain Shams Univ., Heliopolis, Cairo, Egypt]

Studies were conducted on the technological characteristics of spray-dried or pan-dried egg white, previously desugared by (i) fermentation with *Streptococcus lactis*, (ii) fermentation with *Aerobacter aerogenes*, (iii) fermentation with *Saccharomyces cerevisiae* or (iv) enzymic oxidation using glucose oxidase. An imported dried egg white sample was used as a control. Characteristics studied were pH, foaming capacity, and quality of angel food cakes made using the various dried egg whites. Tables of results are given. Of the non-dried samples, foaming capacity and foam stability were best for egg white without glucose removal, followed by (iii). Foaming capacity decreased during drying, except for (iv); the reduction in foaming capacity during drying was greatest for the sample without glucose removal. Of the dried samples, (iii) gave the most stable and (iv) the least stable foam. Pan-drying gave similar foaming capacity and foam stability to spray-drying. pH decreased as a result of glucose elimination (the decrease being greatest for (iv) and least for (i) samples); however, pH increased to values greater than or equal to the original level during drying. Studies on the quality of cakes made with the various egg white samples showed that fresh egg white gave the highest and (ii) the lowest scores for specific vol., texture, tenderness and overall acceptability; (iv) gave the highest and (ii) the lowest scores for flavour. AJDW

## 56

An economical water-jacket for high pressure liquid chromatography columns.

Macrae, R.

*Laboratory Practice* 27 (9) 719-720 (1978) [3 ref. En] [Dep. of Food Sci., Univ. of Reading, London Road, Reading RG1 5AQ, UK]

Small changes in ambient temp. have a significant effect on chromatographic parameters in high pressure liquid chromatography, so that for accurate work it is essential that the column temp. be held constant. This may be readily achieved by using a copper water jacket, the construction of which is described in this paper. (Application to separation of food dyes and to separation of glucose and galactose is shown). AS

## 57

Kinetic studies on the production of single-cell protein from cellobiose.

Lerpido-Barraquio, V. C.; Suga, K.; Okumura, K.; Ichikawa, K.

*Philippine Agriculturist* 61 (1/2) 31-45 (1977)

[10 ref. En] [Dairy Training & Res. Inst., Univ. of Philippines at Los Banos, College, Laguna, Philippines]

Batch cultivation of *Trichoderma viride* QM6a was examined for production of single-cell protein (SCP) and  $\beta$ -glucosidase (cellobiase). Partially purified  $\beta$ -glucosidase had max. activity at 70°C and pH 5.0, was stable from 4 to 30°C with activation energy ( $E_a$ ) 8 Kcal/mol and  $K_m$  1.11 mM. Based on cell mass produced, glucose was a better substrate than cellobiose at pH 5.0. Protein yield (mg N/100 mg cell mass) was 7.69 with glucose and 10.64 with cellobiose. Protein content was fairly constant throughout the cultivation period. A mathematical model was developed based on a possible mechanism of cellobiose degradation. AS

## 58

Use of glucose-galactose concentrates in beer production.

Poznanski, S.; Leman, J.; Bednarski, W.; Szmelich, W.; Kowalewska, J.; Chodkowski, M.; Wieliczko, R.

*Nahrung* 22 (3) 275-283 (1978) [13 ref. En, de, ru] [Inst. of Eng. & Biotech., Food Agrotech. Acad., Olsztyn, Poland]

Studies were conducted on substitution of glucose/galactose concentrates (GGC) for malt in beer manufacture. 3 types of GGC were used: (i) a non-demineralized GGC derived from deproteinized whey; (ii) a demineralized GGC derived from whey; and (iii) a GGC derived from partially purified lactose. The GGC were substituted for  $\leq 50\%$  of the malt in the wort. Data are given for physicochemical properties of the worts and physicochemical properties and organoleptic quality of beers made with (i), (ii) or (iii). The results show that substitution of (ii) or (iii)



for  $\leq 50\%$  of the malt caused no processing difficulties, and gave beers of quality equal to or better than that of control beers. (i) gave a salty flavour to the beer if substituted for  $> 10\%$  of the malt; it also adversely affected the stability and various physicochemical properties of the beer. AJDW

## 59

The control of hygroscopicity, browning and fermentation in glucose syrups.

Kearsley, M. W.

*Journal of Food Technology* 13 (4) 339-348 (1978) [9 ref. En] [Nat. Coll. of Food Tech., Univ. of Reading, St George's Avenue, Weybridge, Surrey, UK]

Catalytic hydrogenation of glucose syrups was studied as a means of controlling hygroscopicity and susceptibility to browning and fermentation reactions, without changing properties such as viscosity, osmotic pressure or sweetness. Glucose syrups in the range 21-100 DE were studied before and after hydrogenation. Hydrogenation significantly decreased ( $P < 0.05$ ) moisture uptake of syrups at 100% RH. L-arginine, DL-alanine, glycine and monosodium glutamate were used as models for browning studies. Browning decreased with DE before hydrogenation of syrups, and hydrogenation (e.g. reduction in DE from 100 to 76) of a syrup reduced colour development when the syrup was heated with amino acids. Overall, hydrogenation of syrups decreased % fermentable sugars, but syrups with initial DE of 21 or 43 hydrogenated to give 0 DE still contained approx. 16% fermentable sugars; 84 and 100 DE syrups hydrogenated to 0 DE contained 0% fermentable sugars. Although this anomaly is unexplained, it was concluded that hydrogenation of glucose syrups could be a useful and easily applied technique. DIH

## 60

[Effect of a centrifugal field on crystallization of sugars.]

Voilley, A.; Sers, M.; Loncin, M.

*Industries Alimentaires et Agricoles* 95 (5) 493-496 (1978) [3 ref. Fr, de, en] [ENSBANA, F-21000 Dijon, France]

The rate of crystallization of glucose from a supersaturated aqueous solution was shown to be increased in a centrifugal field, but crystallization of sucrose was hardly affected. The centrifugal field accelerated only the start of glucose crystallization. Possible industrial application is envisaged. RM

## 61

Survey of sweetener specifications. II.

Anon.

*Bakery Production and Marketing* 12 (6) 118-120, 122, 124-125, 128, 130 (1977) [En]

Part II of the functional description and usage guide for bakery sweeteners deals with corn sweeteners, including dextrose, corn syrups and dry

corn syrup solids. [See preceding abstr. for part I, and following abstr. for part III.] JRR

## 62

Production of dextrose using immobilized glucoamylase.

Allen, B. R.

*Dissertation Abstracts International*, B 38 (4) 1807: Order No. 77-20701, 256pp. (1977) [En] [Lehigh Univ., Bethlehem, Pennsylvania 18015, USA]

A new immobilized-enzyme process for the production of dextrose from partially hydrolysed corn starch has been developed on the bench scale. The process, which utilizes glucoamylase covalently bonded to a relatively inexpensive alumina support in a fluidized-bed reactor, can be used to produce high yields of dextrose ( $> 90\%$ ) from low DE hydrolysates. The experimental program used in developing the process consisted of 2 phases: catalyst preparation; and bench-scale reactor studies. The phases are described in detail. HBr

## 63

The simultaneous isomerization and hydrogenation of glucose in alkali solutions.

Pijnenburg, H. C. M.; Kuster, B. F. M.; Baan, H. S. van der

*Stärke* 30 (6) 199-205 (1978) [24 ref. En, de] [Univ. of Tech., Postbus 513 Eindhoven, Netherlands]

The kinetics of simultaneous isomerization-hydrogenation of glucose were studied at 80-140°C,  $H_2$  pressure 27-135 atm; using Raney Ni catalyst and  $Ca(OH)_2$  or  $NaHCO_3$ -NaOH as a base. The experimental results were well described by a simplified reaction model. The rate constants were determined and activation energies calculated by simulating the course of the reactions with a computer. The apparent isomerization activation energies, related to the hydroxyl independent rate constants, were reduced from an Arrhenius plot. Under the experimental conditions a 27% mannitol yield was obtained from glucose; this is not a max. because hydrogenation rate constants are higher than isomerization rate constants. Higher yields can be obtained at low temp. and lower catalyst concn. AS

## 64

[Limit solvation saturation of a solid [sugar] phase in its saturated solution.]

Smelik, A.

*Listy Cukrovarnické* 93 (12) 270-277 (1977) [41 ref. Sk] [SVST Chemickotechnologická Fak., Bratislava, Czechoslovakia]

If a sufficient level of superfluous solid soluble substance is present, a solvation state of equilibrium and higher concn. of the dissolved substance occur in the saturated solution of such a substance. Intermolecular interaction in the saturated solution is, at a given temp. and atmospheric pressure, governed by ability of the solvent to solvate the

solid, undissolved substance. This behaviour was studied in saturated solutions of D-glucose and sucrose, containing a solid phase; NaCl solutions were also investigated. STI

## 65

**[Suitability of different saccharified starch product: for production of shortbread-type biscuits.]**

Eignung verschiedener Stärkeverzuckerungsprodukte zur Herstellung von Mürbkeksen.

Ludewig, H.-G.; Bretschneider, F.; Grimminger, M.

*Getreide, Mehl und Brot* 32 (4) 100-104 (1978)

[11 ref. De]

Possibilities and limits for use of saccharified starch products in biscuit manufacture were investigated, using 5 glucose syrups of different composition, maltodextrin, and a high-fructose glucose syrup. These products were used individually to replace 10-100% of the castor sugar in a recipe for shortbread-type biscuits. Standard baking tests and tests using a dough forming machine were performed. Compositions of the starch products and biscuit recipes used are tabulated. Effects on appearance, browning, baking time, structure, breaking strength (sensory and instrumental detn.), and sensory taste and texture evaluation are tabulated for 100% and 30% sugar substitution. Mixing curves were recorded during dough preparation. 30% replacement of castor sugar by starch products improved biscuits with respect to better browning appearance and reduced impression of sweetness. Use of maltodextrin gave harder biscuits than control biscuits, and high-fructose syrup gave softer biscuits than control biscuits. 30% replacement of sugar gave no special dough preparation problems with any of the techniques used. DIH



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FAB 20

USE OF GLUCOSE IN FOOD PRODUCTS

SELECTED FROM VOLUME 11  
FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

**under the direction of**

Commonwealth Agricultural Bureaux, Farnham Royal, Bucks; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublicaties en Landbouwdocumentatie (Pudoc), Wageningen.





## INTRODUCTION

Food Annotated Bibliographies (FABs) are collections of abstracts on specific topics in food science and technology. The topics are chosen by the staff of the International Food Information Service as being of particular interest or importance. The topics normally interest individual workers, who may not require the full information provided in Food Science and Technology Abstracts, from which the abstracts for FABs are taken. The size and the cost of the FABs are controlled as much as possible with the interests of individual workers in mind.

Titles of the FABs now available are given on the back cover of this booklet. For up-to-date lists of FABs or suggestions for new topics please write to the address on the back cover. New subjects are searched for at least the five most recent volumes of Food Science and Technology Abstracts. Thereafter each FAB is updated monthly. Copies of each months abstracts on any topic may be obtained as indicated on the back cover of this publication. At the end of each volume of up-dating, the abstracts are merged and made available as a separate supplement to the original FAB.

Some of the larger FABs have been divided into sections to facilitate use. FAB 47 also has a subject and author index provided.

Copies of all original articles referred to in the abstracts may be bought ( or occasionally borrowed) from the International Food Information Service. A form for ordering these is provided at the end of this FAB.

Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES  
EDITOR





## 1

**A sweet end to the whey story.**

Tweedie, L.

*Dairy Technology* 9 (2) 53-57 (1978) [2 ref. En] [Gilbert Chandler Inst. of Dairy Tech., Werribee, Victoria 3030, Australia]

A brief description is given of a process involving acid hydrolysis of lactose in ultrafiltration whey permeate to produce a sweet food-grade syrup. The permeate is passed through a cation exchange system to simultaneously remove minerals (with a positive charge) and replace them with free  $H^+$  ions, is hydrolysed into glucose + galactose in HTST reactor at high temp. and under acidic conditions and finally the remaining negatively-charged minerals are removed by an anion exchange resin and replaced with free  $OH^-$  groups. After passage through a column with activated carbon, the product is concentrated under vacuum (at about 65° C) to produce a glucose-galactose syrup of clean, sweet flavour which can be used in foods as a sweetener. FL

## 2

**Changes in the carbohydrate content of onion bulbs stored for various times at different temperatures.**

Darbyshire, B.

*Journal of Horticultural Science* 53 (3) 195-201 (1978) [19 ref. En] [CSIRO, Div. of Irrigation Res., Private Mail Bag, Griffith, NSW 2680, Australia]

Changes in % dry wt. and in carbohydrate levels and distribution were studied in Golden Brown Lockyer onion bulbs for 3 months at storage temp. of 4°, 15°, 25° and 37° C. The % dry wt. within the bulbs increased from the outer to the inner leaf bases. Storage temp. and length of storage did not influence water loss. Sucrose concn. increased from the outer leaf bases to become highest in the inner leaf bases, and in all leaf bases were higher at higher temp. Glucose and fructose levels also tended to increase from outer to inner leaf bases. After 8 wk fructose levels increased rapidly at the lower storage temp., this is attributed to low temp. hydrolysis of fructans. The only fructan detected was the trisaccharide fraction, which was barely detectable in outer leaf bases and maximal in the inner ones. Trisaccharide levels were generally lower at the lower temp., thus supporting the suggestion of low-temp. hydrolysis of fructans. No information was obtained regarding storage temp. effects on fructans having a higher degree of polymerization than the trisaccharide. The results are discussed relative to temp. and time and the development of storage rots. AS

## 3

**Glucose-fructose isomerization.**

Mitsubishi Chemical Industries Ltd.

*British Patent* 1 503 035 (1978) [En]

Glucose is isomerized to fructose by glucose isomerase activated by the presence of Mg and Fe ions. IFT

## 4

**Dextrose: an alternative to sucrose in panned confections.**

Horn, H. E.

*Manufacturing Confectioner* 57 (6) 79-86 (1977) [6 ref. En]

The solution and crystallization properties of sucrose and glucose (dextrose) are compared, and the implications of the differences for their use in panning are discussed. Glucose exhibits an elbow in the solubility curve at 50° C, as a result of a change in crystal structure from the monohydrate at lower temp. to the anhydrous form at higher temp. Sucrose is more soluble than glucose below 60° C, and vice versa at > 60° C; the rate of change of solubility with temp. is always greater for glucose. Crystallization takes place at widely different supersaturation ratios (SS = solution concn./saturated concn. at same temp.); the boundary of the labile zone, above which crystallization is spontaneous, is 1.4 sucrose and 4.0 for glucose. Latent heats of crystallization are also different, being 4-6 times greater for glucose, depending on the stable crystal form. Consideration of the conditions which prevail in empirically determined sucrose panning procedures allow adaptation to glucose coating without extensive trial and error. JRR

## 5

**Enzymatic isomerization of glucose in hydrolyzed whey lactose syrup.**

Poutanen, K.; Linko, Y.-Y.; Linko, P.

*Nordeuropaeisk Mejeri-Tidsskrift* 44 (4) 90-95 (1978) [10 ref. En, Da, De] [Chem. Fak., Tech. Univ., Helsinki, SF-02150, Espoo 15, Finland]

The utilization of dairy by-products for food and animal feed is limited by the presence, low solubility and sweetness of lactose. To extend the food processing applications of hydrolysed whey lactose syrup, immobilized glucose isomerase technology was investigated in cooperation with the process engineering laboratory of Valio. Glucose isomerase is relatively heat stable with optimum operating temp. of 60-65° C. The substrate should be oxygen free to prevent irreversible denaturation especially at high temp. All known glucose isomerases require a bivalent cation as an activator and/or stabilizer; several other cations inhibit the enzyme. The theoretical max. conversion of glucose to fructose is about 57% although the economical conversion rate is 41-45%. Continuous isomerizations were performed at 60° or 65° C in a packed-bed plug flow reactor using hydrolysed whey lactose syrups of 59% TS, 25% glucose, 25% galactose and 9% lactose. The syrup contained 42 mg Mg and 20 mg Ca/l. after ion-exchange. The inhibitory effect of Ca could be reduced by increasing the level of Mg in the substrate. Increase in glucose content increased fructose formation on continuous isomerization and stabilized the enzyme towards the inhibitory effect of Ca. The relative sweetness of syrup was 80% of the corresponding sucrose solution but an increase of substrate glucose to about 36% resulted in a final product nearly as sweet as sucrose. AGP

## 6

**Free radical generation in crystalline saccharides under grinding processes. [Lecture]**

Hasegawa, H.; Tsuchita, H.; Yamamoto, Y.; Tsuchiya, F. *International Congress of Food Science &*



**Technology - Abstracts** p.194 (1978) [En] [Res. Inst., Meiji Milk Products Co. Ltd., Sakaecho, Higashi-Murayama, Tokyo, Japan]

Stable, free radical production during the grinding of glucose, sucrose and  $\alpha$ - and  $\beta$ -lactose crystals was examined by electron spin resonance techniques. It is concluded that these crystalline saccharides have a molecular structure and that the stable radicals are formed through damage to the chemical bonds of the structure. [See FSTA (1979) 11 2A60.] JA

## 7

[Studies on the constituents of the chicory root.]

Kim, T.-Y.; Yoon, Y. J.; Lee, K.-W.

**Korean Journal of Food Science and Technology** 10 (2) 258-262 (1978) [18 ref. Ko, en] [Sogang Univ., Nat. Ind. Res. Inst., Seoul, S. Korea]

Proximate composition, minerals and fatty acids in dried chicory root (moisture content 7.0%) were determined and results for crude protein, crude fat, crude fibre, total sugar and ash content in chicory root were 8.6%, 1.6%, 6.9%, 58.5% and 4.2%, resp. Mineral contents of Ca, P, Fe, Mg and Si in the root were 1560, 180, 10 600 and 180 mg%, resp. Other minerals such as K, Na, Al, Zn, Ag, Cu and Ti were also determined. Unsaturated fatty acid content in total fat of the root was 65.4%, and was particularly high in linoleic acid. Uridine-5'-diphospho-glucose was detected as sole nucleotide-sugar in the root. AS

## 8

**Effects of varying levels of sucrose, corn syrup solids and vinegar on the quality of sweet pickled peaches.**

Heaton, E. K.; Shewfelt, A. L.; Henderson, L.

**Journal of Food Science** 43 (3) 1015-1018 (1978) [4 ref. En] [Dep. of Food Sci., Univ. of Georgia Agric. Exp. Sta., Experiment, Georgia 30212, USA]

Quality changes in pickled peaches packed in 3 syrup concn. and 5 ratios of sucrose: corn syrup solids (CSS) were studied. Variations in the ratios of sucrose:CSS had no apparent effect on °Brix level or pH of the syrup. Shear press values which denoted increased firmness were associated with osmotic action, which caused shrinkage and loss of drained wt. The more attractive colour of peaches packed in high density syrups (66-69°Brix) and all sucrose syrups was related to higher Gardner 'a' values. Different ratios of sucrose:CSS in the syrups significantly affected the sensory ratings for appearance, colour, aroma, texture and flavour. Sensory quality scores decreased significantly when CSS were used to replace  $\geq 50\%$  of the sucrose in packing syrups. Multiple-comparison sensory difference tests closely paralleled findings from sensory quality ratings. Significant differences existed in sweetness, fruit flavour and general quality but not acidity. It was evident that sourness ratings were influenced by variations in syrup acidity. The Brix and acid levels of pickled peaches could be decreased by approx. 20% without causing significant changes in general quality and fruit flavour. IFT

## 9

**Production of glucose from tapioca (cassava starch) and farinha de mandioca (cassava meal).**

Lages, A. C. A.; Tannenbaum, S. R.

**Journal of Food Science** 43 (3) 1012-1014, 1018 (1978) [30 ref. En] [Dep. of Nutr. & Food Sci., Massachusetts Inst. of Tech., Cambridge, Massachusetts 02139, USA]

Tapioca and farinha de mandioca starches were converted to glucose in a batch laboratory-scale process by the use of a jacketed, stirred-tank reactor. Liquefaction or thinning of the starch slurries was carried out with a thermostable, bacterial  $\alpha$ -amylase that is active and stable in starch solutions at temp.  $> 100^\circ\text{C}$ . The resulting 2-3% dextrose solutions were cooled to  $60^\circ\text{C}$ ; the pH was adjusted to 4.8-5.0 and the solutions were saccharified with low concn. of a fungal amyloglucosidase. Yields of approx. 100 g glucose/100 g starting material were obtained after 12-24 h in saccharification for tapioca starch, and after 24-36 h for farinha de mandioca starch. Rheological problems and potential industrial applications of the processes are discussed. IFT

## 10

**Conversion of starch into glucose by glucoamylases from *Cladosporium resinae* and *Aspergillus niger*.**

Marshall, J. J.

**Abstracts of Papers, American Chemical Society** 176, CARB 53 (1978) [En] [Lab. for Biochem. Res., Howard Hughes Med. Inst., Univ. of Miami School of Med., Miami, Florida 33152, USA]

*A. niger* produces 2 forms of glucoamylase that may be separated by ion-exchange chromatography. The 2 isoenzymes have kinetic constants for a variety of amylaceous substrates that differ greatly. These kinetic distinctions may explain the marked difference in the ability of the 2 isoenzymes to bring about the efficient conversion of amylopectin into glucose. The importance of selecting fermentation conditions that result in selective formation of the more efficient isoenzyme may be inferred from these findings.

*C. resinae* produces several glucoamylases, 1 of which differs markedly from *A. niger* glucoamylase in having the ability to degrade pullulan rapidly. It differs from *A. niger* glucoamylase in not being significantly hindered during its action on amylopectin by the  $\alpha$ -1,6-glucosidic linkages that are present as interchain branch points. AS

## 11

**Development in technique of glucose isomerization.** [Lecture]

Takasaki, Y.

**International Congress of Food Science & Technology - Abstracts** p.39 (1978) [En] [Fermentation Res. Inst., Agency of Ind. Sci. & Tech., Min. of Int. Trade & Ind., 5-8-1, Inage-higashi, Chiba City, Japan]

Starch can be cultivated in wider areas than cane or beet sugar, and starch can be converted by enzyme action to glucose of high purity at low cost. The further stage is discussed of converting glucose to fructose



(much sweeter) by isomerizing enzymes; methods include an enzyme from *Pseudomonas hydrophila* growing in D-xylose or (industrially successful) from a *Streptomyces* sp. growing in a xylan medium. [See FSTA (1979) 11 2A60.] ELC

## 12

**Starch: present status and future potential.** [Lecture] Whistler, L.

*International Congress of Food Science & Technology - Abstracts* p.11 (1978) [En] [Dep. of Biochemistry, Purdue Univ., West Lafayette, Indiana 47907, USA]

Major new food uses of starch as a low-priced polymeric material are considered in relation to glucose-fructose sweeteners and new modified starches for viscosity control and water absorption. [See FSTA (1979) 11 2A60.] ELC

## 13

**Enzymes involved in the generation of glucose from cellulose.** [Lecture]

Woods, T. M.; McCrae, S. I.

*International Congress of Food Science & Technology - Abstracts* p.40 (1978) [En] [Dep. of Carbohydrate Biochemistry, Rowett Res. Inst., Bucksburn, Aberdeen AB2 9SB, UK]

Many microorganisms can attack native cellulose, but their cell-free culture filtrates can rarely do so. Cellulases of 4 exceptional fungi (named) were studied and it was shown that for hydrolysis of highly ordered cellulose, synergistic action of 3 types of enzyme is essential. Factors which influence the rate of hydrolysis and the mechanism of synergistic action between 2 of the enzymes in the early stages are discussed. [See FSTA (1979) 11 2A60.] ELC

## 14

**Optimization of the continuous glucose isomerase reactor system for the high-fructose corn syrup production.** [Lecture]

Ryu, D. Y.; Chung, S. H.; Katoh, K.

*International Congress of Food Science & Technology - Abstracts* p.220 (1978) [En] [Dep. of Biol. Sci. & Eng., Korea Advanced Inst. of Sci., Seoul, S. Korea]

With the objective of optimizing the reactor system, the performance of a plug flow-type continuous glucose isomerase reactor system was both studied experimentally and simulated with the aid of a computer. The most important parameters for optimization were found to be enzyme loading, mean space time of the reactor, substrate feed concn., enzyme decay constants, fractional conversion and kinetic constants. [See FSTA (1979) 11 2A60.] JA

## 15

**Utilization of microorganisms in the production of sugar from Iraqi dates.** [Lecture]

Iraq, Atomic Energy Commission

*International Congress of Food Science & Technology - Abstracts* p.239 (1978) [En] [Nuclear Res. Cent., Tuwaitha, Baghdad, Iraq]

Dates contain approx. 80% sugar (dry wt. basis), the sugars being glucose, fructose and sucrose. Attempts to obtain crystallized sucrose from conc. date juice indicated the necessity of removing glucose and fructose from the juice. This was achieved by using a bacterial strain capable of utilizing glucose and fructose but not sucrose. [See FSTA (1979) 11 2A60.] JA

## 16

**[Desulphitation of fruit juices. IX. Factors affecting the apparent rate and equilibrium constants of the SO<sub>2</sub>-glucose reaction in sulphited orange juice.]**

Vega, A.; Benedito, J.; Escardino, A.

*Revista de Agroquímica y Tecnología de Alimentos* 18 (1) 73-79 (1978) [6 ref. Es, en] [Inst. de Agroquímica Tecnología de Alimentos, Valencia, Spain]

The influence of pH (2.5-4.0) and var. on the apparent rate and equilibrium constants of the SO<sub>2</sub>-glucose reaction in sulphited orange juice was studied at 5-40° C. Results, shown graphically and in tables, revealed that the constants are strongly influenced by pH and temp. but not by var. Empirical equations were derived from experimental data relating the constants with temp. and pH. Values calculated by these equations agreed closely with experimental ones. [See FSTA (1978) 10 11H1443 for part VIII.] AS

## 17

**Mineral complexing properties of glucose syrups and their fractions.**

Gallali, Y.; Birch, G. G.; Kearsley, M. W.

*Journal of the Science of Food and Agriculture* 29 (8) 708-714 (1978) [17 ref. En] [Nat. Coll. of Food Tech., Univ. of Reading, Weybridge, Surrey, UK]

A series of commercial glucose syrups and related fractions (produced by reverse osmosis) of low and intermediate DE (= reducing sugar content, expressed in terms of dextrose and calculated as a % of TS) was complexed with NaCl, CaCl<sub>2</sub> or KI. Detailed study of the complex formation by optical rotation and conductivity techniques revealed that complex formation reached a max. when the salt:carbohydrate ratio was 10-20%. The result was the same for each glucose syrup studied but the alteration of optical rotation or conductivity was predictably higher at lower DE. No marked differences between the commercial glucose syrups and fractions were observed. This suggests that the complex formation was due largely to oligosaccharides in both series of syrups and fractions. AS

## 18

**Use of the Boehringer Reflomat for rapid determination of D-glucose concentration in mixtures of food sugars.**

Birch, G. G.; Gallali, Y. M.; Kearsley, M. W.

*Food Chemistry* 3 (3) 229-233 (1978) [6 ref. En] [Nat. Coll. of Food Tech., Univ. of Reading, Weybridge, Surrey, UK]

The application of the Boehringer remission photometer [Reflomat, see Kattermann et al., *Zeitschrift für Klinische Chemie und Klinische Biochemie* (1974), 12, 43] to food analysis was investigated. Tabulated results of model mixtures of glucose with



10–40 mg/100 g maltose, various glucose syrups (DE 22–62, high fructose glucose syrup) and soft drinks showed reproducibilities of  $\pm 10\%$ , s.d. 0–7.61 (highest s.d. was in mixtures containing glucose and fructose, and in soft drinks). The variable recoveries may be due to differences in viscosity (compared with blood), or to interference of some unusual food sugars with the glucose oxidase detn. RM

## 19

### Separation of aldoses and ketoses by organic resins having primary amine moieties.

Yamaguchi, M.; Asano, T.; Mayama, M.; Iwami, I. *Journal of Food Science* 43 (5) 1620–1623 (1978) [7 ref. En] [Corporate Res. Dep., Asahi-Dow Ltd., 1-3-1, Yako, Kawasaki-ku, Kawasaki City 210, Japan]

Organic resins having primary amine moieties, such as crosslinked polyvinylamine (PVAM), were found to adsorb aldose selectively. A satisfactory separation of glucose and fructose was achieved on a column of PVAM at a flow rate of  $SV = 0.5/h$  with amounts of sugars supplied of 0.4 g/g PVAM. These values indicate that the separation of sugars by the resins can be achieved in a shorter time with a larger amount of sugars in comparison with ion exchange resins usually used. IFT

## 20

### Modification of yeast metabolism by immobilization onto porous glass.

Navarro, J. M.; Durand, G.

*European Journal of Applied Microbiology* 4 (4) 243–254 (1977) [17 ref. En] [Lab. de Genie Biochimique, Inst. Nat. des Sci. Appliquees, Avenue de Rangueil, 31077 Toulouse, France]

Onto porous silica beads (diam. 100–200  $\mu m$ , specific area 6–445  $m^2/g$ ) were grafted  $\gamma$ -aminopropyl-trimethoxysilan groups; the beads, either in this form or after activation of amino groups by glutaraldehyde, were used to immobilize *Saccharomyces carlsbergensis* cells. The retention capacity of the beads and the glucose fermentation of the immobilized cells were studied. In all cases, the cells were fixed to the beads after 15 min; with glutaraldehyde-activated silica, the most porous beads had the greatest retention capacity. Studies of glucose fermentation ( $CO_2$  production, alcohol production, substrate consumption yields) by free and immobilized cells indicated that immobilization results in an increase in the yield of ethanol from glucose and a decrease in the yield of  $CO_2$ ; these results may have implications for commercial alcohol production. JA

## 21

### Gel permeation chromatography of glucose oligomers on polyacrylamide gels. Thermodynamic and steric partition mechanisms.

Heyraud, A.; Rinaudo, M.

*Journal of Chromatography* 166 (1) 149–158 (1978) [10 ref. En] [Cent. de Recherches sur les Macromolecules Vegetales, 53 X, 38041 Grenoble Cedex, France]

The nature of the separation of the maltodextrin, cyclodextrin, cellodextrin and gentiodextrin series has been investigated. The dependence of the partition coeff.  $K_p$  on temp. and on the nature of the oligomers is discussed. The partition coeff. is determined by both energetic and steric factors, so a 2-step mechanism is proposed. Moreover, the experimental data at 65° C can be interpreted on the basis of an exclusion mechanism. AS

## 22

### [Establishing parameters for continuous glucose isomerization station.]

Gulyuk, N. G.

*Sakharnaya Promyshlennost'* No. 8, 70–73 (1978) [Ru] [NPO po Krakhmaloproduktam, USSR]

Sugar is being widely replaced by isomerized syrup, produced enzymically. The most efficient process is continuous isomerization using gluco-isomerase and glucose solution. Danish isomerase efficiency drops to 50% after 500 h; the preparation is replaced after 1000 h, and there is a drop (to 25%) of the rate of flow of substrate passing through the column toward the end of this period. Therefore 3, 6 or 9 columns are necessary. Equations are given to compute the parameters and vol. of the columns. STI

## 23

### [Glucose isomerization.]

Japan, Agency of Industrial Science & Technology *Japanese Examined Patent* 5 328 990 (1978) [Ja]

A process is described for the isomerization of glucose to fructose which employs enzymes, with the reaction being effected in the presence of a boric acid-type anion exchange resin to improve yield. IFT

## 24

### [Glucose isomerization.]

Electro-Chemical Industry Co. Ltd.

*Japanese Examined Patent* 5 328 973 (1978) [Ja]

A process is described for the continuous isomerization of glucose to fructose which employs a fixed glucose isomerase enzyme in 2 separate fixed bed column reactors. IFT

## 25

### Methods of isomerizing glucose to fructose.

Kanno, T.; Watanabe, H.; Sano, S. (Showa Sangyo Co. Ltd.)

*United States Patent* 4 106 987 (1978) [En]

A method is described of isomerizing glucose to fructose which involves contacting a stream of an aqueous glucose solution with a hydrogel of an edible substance (agar-agar, gelatine, collagen, pectin, locust bean gum, casein, wheat gluten, egg white, soy protein, persimmon tannin) and thereafter contacting with an anion exchange resin, said hydrogel containing dispersed cells of a microorganism having glucose isomerase activity. IFT



## 26

[Glucose syrups from corn.] [Lecture]  
Simon, J.

*Annales de la Nutrition et de l'Alimentation* 32 (2/3)  
681-688 (1978) [Fr, en] [Soc. des Produits du Mais, 379  
Avenue du General de Gaulle, 92142 Clamart, France]

This review describes the properties, manufacture and utilization of glucose syrup and isomerized corn syrup (high-fructose corn syrup). Glucose syrups can increase the degree of supersaturation of sugars and control the viscosity and hygroscopic property of end products. Their main fields of application are in the confectionery, bakery and ice cream industry. Fructose syrups have high relative sweetness (42%), osmotic pressure and humectant properties and find their main applications in beverages, soft candies and canned fruits. [See FSTA (1979) 11 5A346.] RM

## 27

High fructose corn syrups for bread products.  
LaBaw, G. D.

*Bakers' Digest* 51 (5) 104-106 (1977) [En] [Fleischmann Lab., Standard Brands Inc., Stamford, Connecticut, USA]

High-fructose corn syrups (HFCS) offer an economic source of fructose (levulose) to the baking industry. HFCS have high sweetness levels and high fermentability. Their low viscosity and reduced tendency to crystallization make handling, storage and blending easy. JRR

## 28

[Glucose-fructose separation.]

Tazuki, R.

*Japanese Examined Patent* 5 339 492 (1978) [Ja]

A mixed solution of fructose and glucose is separated by adjusting the pH to 8.5 and adding NaCl to precipitate a glucose-sodium chloride double salt. IFT

## 29

[Permissibility of high fructose glucose syrups in the manufacture of sweet, non-alcoholic soft drinks, and their labelling.] Die Zulässigkeit der Verwendung von hochfructosehaltigem Glukosesirup bei der Herstellung süsser alkoholfreier Erfrischungsgetränke und ihre Kennzeichnung.

Hahn, P.

*Zeitschrift für das Gesamte Lebensmittelrecht (ZLR)* 5 (4) 567-573 (1978) [De]

The author concludes from an analysis of the relevant legal documentation that labelling of the title beverages as containing high fructose glucose syrups is not mandatory in the Federal Republic of Germany. HBr

## 30

Total reducing sugar, fructose and glucose concentrations and root yield of two chicory cultivars as affected by irrigation, fertilizer and harvest dates.  
Chubey, B. B.; Dorrell, D. G.

*Canadian Journal of Plant Science* 58 (3) 789-793 (1978) [10 ref. En, fr] [Res. Sta., Agric. Canada, Morden, Manitoba ROG IJO, Canada]

The effects of several management practices on the carbohydrate composition and root yield of 2 chicory (*Cichorium intybus* L.) cultivars were investigated during 2 successive seasons. Supplemental irrigation and fertilizer did not affect the carbohydrate quality and yield parameters. The 2 cultivars varied considerably in their performance in the 2 yr, ranging from 17.4 to 19.2% in total reducing sugars of which 79.2-81.9% was fructose and 18.1-20.8% was glucose. Root yields ranged from 20.08 to 35.68 t/ha. Delayed harvesting in both years increased root yield, total reducing sugars and glucose concn. but decreased fructose concn. Chicory has the potential of producing a good quality carbohydrate product and deserves serious consideration as a high fructose crop. AS

## 31

Linkage analysis in commercial and fractionated glucose syrups.

Birch, G. G.; Foyle, R. A. J.; Gallali, Y. M.

*Journal of the Science of Food and Agriculture* 30 (1) 85-88 (1979) [8 ref. En] [Nat. Coll. of Food Tech., Univ. of Reading, St George's Avenue, Weybridge, Surrey, UK]

The degree of branching ( $\alpha$ -1,6 linking) in commercial glucose syrups and in syrups prepared by reverse osmosis was studied. Glucose syrups of both types, having DE 18-65 were methylated and hydrolysed, the methylated alditols were prepared by reduction, and these were analysed by GLC after acetylation. The % of non-reducing end groups, reducing end groups + 1,4-linked groups, and 1,4,6-linked branch groups are tabulated for each syrup (the procedure used precluded identification of 1,6-linked groups). % 1,4,6-linked branch groups decreased (from 8% to 3%) with increasing DE, as expected, and syrups prepared either commercially or by reverse osmosis and of comparable DE, had similar degrees of branching. The results were confirmed by pullulanase digestion, although the absolute values for degree of branching differed from the chemical studies, perhaps because of impurity of the enzyme preparation. It was concluded that the reverse osmosis process does not discriminate between branched and linear oligosaccharides. AS

## 32

[Synthesis of volatile acids by immobilized cells of propionic-acid bacteria.]

Vorob'eva, L. I.; Alekseeva, M. A.; Surkova, I. G.; Gaitan, V. I.

*Prikladnaya Biokhimiya i Mikrobiologiya* 13 (4) 531-538 (1977) [19 ref. Ru, en] [Moscow State Univ., Moscow, USSR]

Polyacrylamide gel immobilized cells of propionic-acid bacteria were able to synthesize propionic and acetic acids during fermentation of glucose and starch. The activity of acid synthesis in immobilized cells was 30% lower than that in free cells. After 7 months of function of immobilized cells the synthesis of volatile acids was 50% lower than the initial productivity. Electron microscopic studies showed that the reduction of acid synthesis was associated with the lysis of a major portion of cells. Immobilized cells differed from



free cells in their greater thermal stability and accumulated a max. amount of acids at 37°C and pH 6.2-7.0. In spite of multiple function of immobilized cells for 7 months, no supplements of cofactors to the incubation mixture were needed. AS

### 33

#### Enzyme collagen membrane for electrochemical determination of glucose.

Thevenot, D. R.; Sternberg, R.; Coulet, P. R.; Laurent, J.; Gautheron, D. C.

*Analytical Chemistry* 51 (1) 96-100 (1979) [13 ref. En] [Lab. d'Energetique Biochimique, Univ. Paris Val de Marne, Avenue du General de Gaulle, F94010, Creteil Cedex, France]

A new trace glucose analyser has been designed using electrochemical sensors. The differential device includes a glucose sensor consisting of a modified gas electrode in which the pH detector was replaced by a platinum disk and the porous film by a collagen membrane on which  $\beta$ -D-glucose oxidase was covalently bound after an acyl-azide activation process; and a compensating electrode mounted with a nonenzymic collagen membrane. After injection of a glucose-containing sample into the reaction vessel, where the probes are immersed, an anodic current is detected at the enzyme working electrode. Current outputs of both electrodes are subtracted and twice differentiated; a steady state is reached and the stationary and dynamic responses are recorded. Both responses are proportional to glucose concn. in the 0.1  $\mu$ M-2 mM range, and reproducibility was found to be >2% using these conditions. The extreme sensitivity exhibited by the system, i. e. 10 nM, is better than previously reported data by 3 orders of magnitude, and is very favourable for trace glucose assays in food and biological samples. AS

### 34

#### Brewing with syrups.

Pfisterer, E. A.; Garrison, I. F.; McKee, R. A.

*Technical Quarterly, Master Brewers' Association of the Americas* 15 (2) 59-63 (1978) [18 ref. En, es]

Even in breweries with cereal cookers the addition of syrup adjunct to the kettle is becoming more and more attractive since it provides sufficient increase in brewhouse capacity at a lower cost than a major expansion. Unfortunately, because of the high glucose content in these syrups, not all yeast strains may adapt equally well to the resultant change in the fermentable carbohydrate spectrum. Depending on the malt/adjunct ratio, the glucose concn. can increase up to 300% in the syrup adjunct wort as compared to a control wort. A production ale yeast appeared to be sensitive to the elevated glucose levels in these worts and seemed to exhibit a repression of the maltose uptake system (Catabolite Repression); this resulted in 'hanging fermentations' with unacceptably high amounts of yeast fermentable extract in the beers at dropping. Although it was possible to end ferment the syrup adjunct worts by changing brewing and fermentation conditions, a more convenient alternative arose when a high maltose and low glucose syrup became available in Canada. By

using a maltose-releasing enzyme rather than glucoamylase after the acid conversion of starch, a distribution of fermentable carbohydrates is achieved in the syrup which almost matches the pattern found in wort. Addition of the high maltose syrup to the kettle did not affect the fermentation performance of ale yeast. AS

### 35

#### Enzymatic analysis for glucose and fructose.

McCloskey, L. P.

*American Journal of Enology and Viticulture* 29 (3) 226-227 (1978) [3 ref. En] [Ridge Vineyards Inc., Cupertino, California 95014, USA]

A rapid 10-min assay for reducing sugars in wine and grape juice is described utilizing prepared reagents. The assay is enzymic, using hexokinase, and is a batch method capable of  $\leq 100$  assays/h. The method is suitable for determining low levels of reducing sugars in dry table wines. AS

### 36

#### Instrument runs 20 specific sugar assays per hour.

Huntington, J.

*Food Product Development* 12 (7) 78-79 (1978) [En] [Yellow Springs Instrument Co. Inc., Yellow Springs, Ohio, USA]

A new instrument, the YSI Model 27 Industrial Analyzer, can be used to measure directly and accurately the concn. of dextrose, sucrose and lactose in products like gelatin desserts, cookies, cereals, instant breakfast foods, carbonated soft drinks, wines, whole and dried milks and non dairy creamers. Sample preparation is limited in general to obtaining the sample in liquid form. Immobilized enzyme technology is combined with electrochemical oxidation at a platinum electrode, a linear method with good calibration stability. The detn. of dextrose in a beverage is described to illustrate the use of the instrument. While reproducibility with the instrument is 2% plus 1 digit, calibration before each reading gave values reproducible within 1% across 3 instruments for lactose in milk, sucrose in breakfast cereal, and glucose in wine. The analyser exhibits sensitivity of  $\pm 2$  digits, linearity of  $\pm 2\%$  below the calibration point and linearity of  $\pm 5\%$  above the calibration point. VJG

### 37

#### The rapid determination of dextrose equivalent of glucose syrups.

Kearsley, M. W.

*Journal of the Association of Public Analysts* 16 (3) 85-88 (1978) [4 ref. En] [Nat. Coll. of Food Tech., Univ. of Reading, St. George's Avenue, Weybridge, Surrey, UK]

A rapid method is described for the detn. of DE of glucose syrups. The method is based on the fact that osmotic pressure of glucose syrups is directly proportional to the DE of the syrup at constant refractive index. Calibration graphs have to be drawn initially but each detn. thereafter takes only 2-3 min. AS



## 38

[Biotechnological research into production of glucose-fructose syrups. II. Kinetic investigation of the mechanism of glucose isomerization.] Zur biotechnischen Erforschung der Herstellung von Glucose-Fructosesirupen. II. Reaktionskinetische

Untersuchung des Mechanismus der Glucoseisomerisierung.

Laszlo, E.; Hoschke, A.; Hollo, J.

*Stärke* 30 (7) 242-245 (1978) [4 ref. De, en] [Tech. Univ. Budapest, Gellert Ter 4, 1521 Budapest, Hungary]

The mechanism of enzymic isomerization of glucose was studied by means of reaction kinetics. Kinetic constants were established for glucose, 6-deoxyglucose, sorbitol and 2-deoxysorbitol. Using  $^3\text{H}$ -labelled glucose (on  $\text{C}_2$ ), it was observed that the rate-limiting step was binding of the acyclic (linear) glucose molecule to the enzyme. The relative binding affinities to glucose isomerase for 2-deoxyglucose, sorbitol and glucose were 7.6, 3.7 and 1. The aldehyde group has the highest binding energy, so that opening of the ring is independent of the enzyme action: this is the reason for the relatively slow enzyme isomerization. The rate of isomerization could only be increased by induced splitting of the pyranose ring. This can be achieved in model experiments but is not feasible on an industrial scale. [See FSTA (1976) 8 1L102 for part I.] RM

## 39

[Biotechnological research into production of glucose-fructose syrups. III. Kinetic investigations of immobilized glucoamylase.] Zur biotechnologischen Erforschung der Herstellung von Glucose-Fructosesirupen. III. Kinetische Untersuchungen immobilisierter Glucoamylase.

Hollo, J.; Hoschke, A.; Laszlo, E.

*Stärke* 30 (12) 414-419 (1978) [13 ref. De, en] [Tech. Univ. Budapest, Gellert Ter 4, 1521 Budapest, Hungary]

The production of immobilized glucoamylase (on DEAE pearl cellulose, granule size 200-250  $\mu\text{m}$ , exchange capacity 0.9 m-equiv./g) by a new method of immobilization is described. Kinetic properties of the product were studied in batch stirred tanks, continuous flow stirred tanks and column reactors; results are shown graphically. It was found that a stationary diffusion boundary layer, formed around the carrier granules, together with the pore vol. inhibited diffusion and significantly affected the kinetic constants. It also resulted in practically complete hydrolysis of the dextrin substrate: as a result of diffusion conditions, the reaction product was practically all glucose. Up to 92% conversion, the reaction kinetics differed from those for soluble glucoamylase. An optimum method of using the immobilized enzyme for industrial glucose-fructose syrup production was developed. Detn. of the optimal flow rate is decisive for successful operation. [See preceding abstr. for part II.] RM

## 40

Temperature dependence of stability and activity of an immobilized glucose isomerase in a packed bed.

Roels, J. A.; Tilburg, R. van

*Stärke* 31 (1) 17-24 (1979) [10 ref. En, de] [Gist-

Brocades NV, PO Box 1, 2600 MA Delft, Netherlands]

A mathematical model was developed, describing the kinetics of the glucose-fructose conversion by an immobilized glucose isomerase. The model is based on the known kinetic behaviour of glucose isomerase and on limitations imposed by the diffusion resistance of a spherical particle. It was used to derive a relation between initial enzyme activity and temp., which was shown to deviate from the familiar Arrhenius plot; the same applied to the activity half life time in a packed bed column. Experimental material confirming the theoretical considerations is presented. Experimental results were used to determine some important parameters. An Arrhenius-type relation is shown to hold for the estimated enzyme activity as well as for the kinetics of deactivation. The parameters obtained can be used in temp. optimization studies for packed bed conversion processes. The effects of initial activity, particle size and temp. on fructose production are discussed. AS

## 41

[Glucose syrups.]

Colombia, Instituto Colombiano de Normas Tecnicas *Colombian Standard* ICONTEC 610, 3pp. (1978) [Es] [Apartado Aereo 142 37, Bogota, Colombia]

Aspects covered include: definition of the product; classification into (i) liquid and (ii) dry types; quality requirements; sampling; testing and analysis; and packaging and labelling. Physicochemical quality requirements include the following: sp. gr. at 20°/20°C, (i) 71-85°Brix, 38-45°Baume; moisture content at 80°C, (i) 13-22.5%, (ii)  $\leq 2\%$ ; dextrose equivalent (DM basis), 20-70% for (i) and (ii); pH, 4.5-5.3 for both (i) and (ii); ash, 0.05-0.3 for (i);  $\text{SO}_2$ ,  $\leq 350$  p.p.m. for (i) and (ii); and Fe, 5 p.p.m. for both (i) and (ii). Neither type may be turbid, or contain starch. Colour requirements for (i), expressed in Lovibond units, are also specified. AJDW

## 42

[Lactic acid formation and browning due to alkaline hexose degradation.] Milchsäure- und Farbstoffbildung infolge des alkalischen Hexoseabbaues.

Andres, H.; Pichler, B.; Prey, V.

*Zuckerindustrie* 103 (9) 753-756 (1978) [4 ref. De, en, fr, es] [Inst. für Chem. Tech. Organischer Stoffe, Tech. Univ. Wien, Getreidemarkt 9, A-1060 Vienna, Austria]

Alkaline hexose degradation was monitored by UV absorption at 190-390 nm, colour formation by extinction at 420 and 560 nm, polymerization by Br number (double bonds), endiolcarbonyl groups by the Tillmann reaction, and lactic acid production by enzymic lactate analysis. Results, shown graphically, revealed that UV and visible absorption start already under mild conditions, within the first 3 min, suggesting the UV-active compounds are formed before colour development. No firm statement could be made on a possible equilibrium between browning products and lactic acid, though long-term liming experiments seemed to suggest its existence. Glucose degradation with lime and  $\text{O}_2$  (compressed air) over 2 h produced a distinct reduction in extinction and also in lactic acid formation. RM



## 43

The production of high-saccharified syrups by two stage enzymatic hydrolysis of potato starch. II. The effect of starch concentration on its saccharification with minimum amounts of glucoamylase preparations and at an unchanged pH during whole process of hydrolysis.

Sroczyński, A.; Pierzgalski, T.; Nowakowska, K. *Acta Alimentaria Polonica* 4 (1) 63-70 (1978) [16 ref. En, pl] [Inst. Chem. Tech. Zywnosci, Politech., Lodz, Poland]

Starch was hydrolysed in water suspensions of 30, 40 or 50% concn. by the joint action of (i)  $\alpha$ -amylase Novo 264 followed by glucoamylase (GA) Sumzyme, (ii)  $\alpha$ -amylase Novo 264 and GA Novo 2, or (iii)  $\alpha$ -amylase HT-1000 and GA Diazyme L-30, in each case with 10  $\times$  less GA preparation than normally used for producing glucose from starch. Temp. were the optimum recommended for the particular enzymes, and a constant pH of 5.5 was maintained throughout. DE values (total reducing sugars) were determined at intervals between 0 and 72 h, and results are tabulated for each starch concn. Contents of individual carbohydrates in the hydrolysates were also determined by chromatography. Highly saccharified syrups (55-70 DE) were obtained from starch suspensions of 30-50%, but the 30% suspensions yielded DE values 1.5-6.5  $\times$  higher than those from 50% suspensions. With increased reducing sugars the content of glucose increased, while dextrins and maltose oligosaccharides decreased and maltose remained about constant at 16% of DM. Optimum hydrolysis time was 36-48 h; the enzyme combination (ii) produced the highest content of reducing sugars. ELC

## 44

**Production of glucose isomerase by *Streptomyces flavogriseus*.**

Chen, W. P.; Anderson, A. W.; Han, Y. W. *Applied and Environmental Microbiology* 37 (2) 324-331 (1979) [35 ref. En] [Dep. of Microbiol., Federal Res., USDA, Oregon State Univ., Corvallis, Oregon 97331, USA]

To increase the sweetness of starch syrup for use as a sugar substitute, glucose isomerase is used to convert glucose in corn syrup to fructose. The characteristics are reported of a microorganism isolated from soil, and identified as *Streptomyces flavogriseus*, which produces a good quantity of glucose isomerase when grown on straw hemicellulose or on  $H_2SO_4$  hydrolysate of straw. Cultural conditions required for production of the enzyme are discussed. AL

## 45

**Immobilization of glucose isomerase-containing *Streptomyces phaeochromogenes* cells in fine-particle form.**

Kumakura, M.; Yoshida, M.; Kaetsu, I. *Applied and Environmental Microbiology* 37 (2) 310-315 (1979) [14 ref. En] [Takasaki Radiation Chem. Res. Establishment, Japan Atomic Energy Res. Inst., Takasaki, Gunma, Japan]

Immobilization of cells containing glucose isomerase is of practical application in the production of high-

fructose syrup, as fructose is now one of the important sugar sources. A new preparation method is reported for immobilizing cells in fine-particle form, using hydrophilic glass-forming monomers, and employing a salting out technique and radiation-induced polymerization at low temp. AL

## 46

**Experience with empirical methods for evaluating pressure drop properties of immobilized glucose isomerase.**

Norsker, O.; Gibson, K.; Zittau, L. *Stärke* 31 (1) 13-16 (1979) [En, de] [Novo Ind. A/S, Novo Alle, DK-2880 Bagsvaerd, Denmark]

Prediction of pressure drop over a bed of immobilized glucose isomerase was studied by simulating different locations in large columns with the aid of smaller laboratory apparatus. Experimental results were evaluated by empirical numerical analysis and compared with results from pilot plant columns of 2-3 m bed height. The laboratory apparatus and the correlations outlined provide a convenient and relatively quick method for evaluating the mechanical properties of enzyme preparations for use in industrial reactors. RM

## 47

**[Method for preparation of dextrose and dextrins from protein-containing starchy materials.]** Verfahren zur Herstellung von Dextrose und Dextrinen aus eiweisshaltigen Stärkerohstoffen.

Müller, H.

*Swiss Patent* 608 830 (1979) [De]

The raw materials are starchy materials obtained from potato, maize and other grains, tapioca, etc., which are hydrolysed to dextrose by acid or enzymes and the protein separated out by ultrafiltration. The protein so separated has excellent solubility in water and can be used as a foodstuff of high nutritional value. W&Co

## 48

**Noncariogenic comestible.**

Muhler, J. C.; Kleber, C. J.; Kelly, R. G. (United States of America, Indiana University Foundation)

*United States Patent* 4 134 999 (1979) [En]

Noncariogenic comestibles are described which contain sweetener compositions comprising sorbitol or xylitol (75% by wt.) together with a 2nd component comprising glucose or fructose (60% by wt.). IFT

## 49

**Enzymatic treatment of whey permeate with recovery of enzyme by ultrafiltration.**

Norman, B.; Severinsen, S. G.; Nielsen, T.; Wagner, J. *World Galaxy* No. 7, 20-23 (undated) [En]

A new process in which permeate from the ultrafiltration of milk or whey is treated with LACTOZYM 750 L, a purified  $\beta$ -galactosidase prepared from the yeast *Kluyveromyces fragilis*, and the enzyme recovered by ultrafiltration and recycled is described. The enzyme in liquid form has an activity of 750 NOVO Lactase units/ml. Typical results from a 1500 l. batch



process for hydrolysis of whey permeate at 5°C are given and show an average conversion of 77%. Examples are given, including economic evaluation for the processing of hydrolysed whey permeate into glucose-galactose syrup and a milk with low lactose content. AGP

## 50

**Comparison of antioxidant activity of ethanol-extracts obtained from glucose-ammonia and glucose-glycine browning mixtures.**

Lee, H.-H.; Kim, D.-H.

*Korean Journal of Food Science and Technology* 10 (3) 350-355 (1978) [18 ref. En] [Dep. of Food Tech., Coll. of Agric., Korea Univ., Seoul, S. Korea]

An attempt was made to compare the antioxidant activity of ethanol extracts of a glucose-ammonia (0.2M + 0.2M) browning mixture with that of the corresponding glucose-glycine mixture, in soybean oil substrates, on the basis of peroxide value (POV), thiobarbituric acid value (TBA-value) and acid value (AV) development. Absorbances, at 470 nm, of the former mixture after 2 and 5 h browning were 1.88 and 3.42 resp., while those of the latter mixture were 0.02 and 0.07. The POVs (m-equiv./kg oil) of the substrates containing the extracts taken after 2, 15 and 40 h from the former mixture were 15.8, 14.2, and 12.6 resp. after 30 days storage at  $42.3 \pm 2.6^\circ\text{C}$ . Those of the latter mixture were 17.4, 16.1, and 15.8 and that of the control was 82.1. TBA and acid value development followed similar trends. These results indicated that the antioxidant activity of the extracts of the glucose-ammonia mixture was slightly stronger than that of the glucose-glycine mixture, and also suggest that effective antioxidants had already been formed in the earlier stages of the glucose-ammonia mixture, and that brown-pigments formed did not contribute significantly to the activity of the mixture. AS

## 51

**A simple gas chromatographic procedure for the determination of sugars in brewing materials.**

Jamieson, A. M.

*Journal of the American Society of Brewing Chemists* 34 (1) 44-48 (1976) [5 ref. En] [Molson Breweries of Canada Ltd., Montreal, Quebec, Canada H2L 2R5]

A simple, rapid, and precise method for detn. of fermentable sugars in brewing materials was developed. A single peak for each sugar is obtained by addition of hydroxylamine hydrochloride to form the sugar oxime prior to formation of the trimethylsilyl ether. By using an excess of hexamethyldisilazane, wort and corn syrup samples could be analysed without the need of freeze-drying, although this was necessary to obtain the sensitivity required to analyse beer. Methods are given for the analyses of wort, corn syrup, and beer. Data are given for injection and analysis precision of these methods. Their application to brewing problems is shown by following a fermentation and analysing a beer high in real fermentable extract. AS

## 52

**Brewing sugars and syrups.**

Blau, T. (Chairman)

*Journal of the American Society of Brewing Chemists* 34 (3) 103-104 (1976) [7 ref. En]

In a collaborative study, 2 corn syrup samples were analysed for glucose, maltose and triose using 2 published GLC methods and 1 published high-pressure liquid chromatography (HPLC) method. A brief outline of each method is given. The between-laboratory (BL) error was lowest for all detn. with the HPLC technique. The within-laboratory (WL) error was lowest for glucose and maltose with the trimethylsilyl (TMS) method for GLC, and lowest for triose with the HPLC method. Both BL and WL errors were highest for glucose, maltose and triose with the oxime-TMS GLC method. All 3 methods showed systematic errors according to the F-test ( $P \leq 0.05$ ). JRR

## 53

**Preparation of D-mannitol.**

Towa Kasei Kogyo Co. Ltd.

*British Patent* 1 539 457 (1979) [En]

A process is described for the conversion of glucose to D-mannitol by the partial epimerization to mannose using a Mo catalyst, followed by hydrogenation. IFT

## 54

**Kinetics of the production of biologically active Maillard browned products in apricot and glucose-L-tryptophan.**

Lee, C. M.; Lee, T.-C.; Chichester, C. O.

*Journal of Agricultural and Food Chemistry* 27 (3) 478-482 (1979) [20 ref. En] [Dep. of Nutr. & Food Sci., Drexel Univ., Philadelphia, Pennsylvania 19104, USA]

Some properties of Maillard browning products and kinetics of their formation were studied using a natural food system (apricot) and a model system (glucose-tryptophan). The water-soluble products responsible for deterioration of the normal nutritional state were formed in the early stages of browning. Butanol-soluble products attributable to adverse physiological effects were formed in a later stage. Kinetically, a significant proportion of the parent compounds were degraded, and a max. yield of Amadori compounds was attained even before an appreciable amount of brown colour developed. Rate of formation of browning products showed a linear relationship with reaction time and temp. until the parent compounds were no longer available. After depletion of parent compounds, polymerizations between the remaining products and partial degradation of Amadori compounds occurred. The products became less soluble in polar solvents as further polymerization proceeded. AS

## 55

**Letters to the editor. [Letter]**

Aust, R. B.; Pennell, M. D. (H. J. Heinz Co. of Canada Ltd.)

*Journal of the Canadian Dietetic Association* 40 (2) 97 (1979) [En]



This letter comments that the data reported by Korsrud & Trick in their paper entitled Sucrose, fructose and glucose contents of infant cereals [see FSTA (1979) 11 5E394] was based on infant cereals obtained in late Nov. 1976 and do not reflect the products currently available in Canadian supermarkets. In the last 3 yr many products have been modified by removal or reduction of sugar, removal of salt and other ingredients e.g. hydrolysed vegetable proteins. A further letter from G. H. Anderson of the Department of Nutrition & Food Science, University of Toronto, Canada, comments that the report deals with out-dated products, and that the manufacturer is a better source of data when formulations change so quickly. AL

## 56

**Stability of color in plum and strawberry juices during storage.**

El-Kady, S.; Ammar, K.

*Journal of Agricultural Research, Tanta University* 3 (1) 99-111 (1977) [15 ref. En] [Dep. of Food Sci., El-Mansoura Univ., Mansoura, Egypt]

Studies were conducted on effects of addition of sucrose, fructose or glucose (to give a total soluble solids concn. of 15%) or ascorbic acid (at concn. of 20-200 mg/100g) on the colour stability of strawberry and plum juices during storage in 100 ml glass bottles for  $\leq 5$  months at 2-4°C. Control samples received no additives. Colour intensity and degree of browning were determined by spectrophotometry. Graphs of results are given. The results show that sucrose slightly and fructose considerably impaired colour retention; glucose improved colour retention of both juices. Plum juice without added sugars showed less browning than the samples with sugars. Fructose gave the most browning, followed by sucrose and glucose. For strawberry juice, the fructose-containing sample gave the most and the sucrose-containing sample the least browning, the glucose-containing and control samples giving only slightly greater browning than the sucrose-containing sample. Browning and loss of colour increased with increasing added ascorbic acid concn. and increasing storage time. 20-30% of added ascorbic acid was lost during storage; it is suggested that anthocyanins may increase the stability of ascorbic acid. In general, changes in the colour of plum juice were less than changes in that of strawberry juice. AJDW

## 57

**Determination of glucose, fructose and sucrose in molasses by high-performance thin-layer chromatography.**

Lee, K. Y.; Nurok, D.; Zlatkis, A.

*Journal of Chromatography* 174 (1) 187-193 (1979) [17 ref. En] [Dep. of Chem., Univ. of Houston, Houston, Texas 77004, USA]

The title sugars are simultaneously determined in molasses by high performance TLC (HPTLC) to give rapid and precise detn. Merck HPTLC plates coated with silica gel 60 are used after being impregnated with monobasic potassium phosphate by dipping in 0.2M solution and drying. Three 30-min developments using ethyl acetate/pyridine/water 8:2:1 give baseline

separation of the sugars. Sugars are visualized with a diphenylamine/aniline/H<sub>3</sub>PO<sub>4</sub>/acetone solution and quantitatively determined by scanning the plates with a reflectance spectrophotometer. Relative s.d. for fructose, glucose and sucrose were 2.2, 4.3 and 1.1%, resp. and corresponding recoveries from spiked molasses were 79-82, 87 and 91%, for additions of 10-80 ng/300 ng molasses. DIH

## 58

**High pressure liquid chromatographic determination of saccharides in corn syrups: collaborative study.**

Engel, C. E.; Olinger, P. M.

*Journal of the Association of Official Analytical Chemists* 62 (3) 527-532 (1979) [4 ref. En] [Clinton Corn Processing Co., Clinton, Indiana 52732, USA]

A liquid chromatographic method for quantitative analysis of saccharides in corn syrup was investigated. Fructose, glucose, and related saccharides are separated on an Aminex 50W-X4, calcium form, cation exchange column or, alternatively, on an Aminex Q15-S, calcium form, cation exchange column. Water is the solvent. All carbohydrate components in the syrup elute from the column, permitting normalized computation vs. synthetically prepared standards. The corn syrup samples are diluted to an approximate DM content and injected directly into the chromatograph. When required, interfering ionic material is removed with the aid of a mixed strong acid-weak base ion exchange resin. The reproducibility and repeatability coeff. of variation for fructose (on samples ranging from 15 to 90% fructose) are 0.9 and 0.3%, resp. The reproducibility and repeatability coeff. of variation for glucose (on samples ranging from 8 to 50% glucose) are 1.4 and 0.5%, resp. The method has been adopted as official 1st action. AS

## 59

**Estimation of dextrose equivalent value of starch hydrolysates from liquid chromatographic profiles.**

Kiser, D. L.; Hagy, R. L.

*Abstracts of Papers, American Chemical Society* 177 (1) AGFD 6 (1979) [En] [Grain Processing Corp., 1600 Oregon Street, Muscatine, Iowa 52761, USA]

Dextrose equivalent (DE), a term used to indicate the degree of hydrolysis of starch, is routinely determined by a rigid titration procedure. Starch hydrolysates are better characterized by liquid chromatographic profiles of the various saccharide components. DE, when needed, can be estimated from liquid chromatographic data. Methods for estimation and the validity of estimations are discussed. Examples of profiles and DE data from a range of starch hydrolysates are presented. AS

## 60

**Process for immobilizing glucose isomerase.**

Enokizono, S.; Ushiro, S. (CPC International Inc.)

*United States Patent* 4 144 127 (1979) [En]

Glucose isomerase is immobilized in an active form by adsorbing the glucose isomerase onto a colloidal silica. The enzyme is contacted with the colloidal silica and the resulting composite solidified by freezing.



Optionally, the composite may be gelatinized prior to freezing. The composite is then used for the isomerization of glucose to fructose. AS

## 61

**Basic trials on possible industrial applications on an immobilized glucose oxidase-catalase system.**

Hartmeier, C. H.

*Biotechnology Letters* 1 (1) 21-26 (1979) [5 ref. En]

[C. H. Boehringer Sohn, D-6507 Ingelheim/Rhein, Federal Republic of Germany]

The glucose oxidase-catalase system from *Aspergillus niger* fixed via glutardialdehyde binding on particles of insolubilized inactive protein [see Hartmeier, Belgian Patent 857 718 (1977)], particle size 20-50  $\mu\text{m}$  is commercially available as BOEROGEL-GK-400 as a 10% suspension with activity of 400 Sarett-units/g suspension. At optimum pH 5-6, stability is 24 h at 30°C; at optimum temp. 40°C, 1 h at pH 6.0. Examples of application shown by means of diagrams are glucose oxidation in glucose-fructose mixtures and  $\text{O}_2$  removal from beer (from 1.76 to 0.06 mg/l., in a frame reactor pilot plant). RM

## 62

**Full bodied, firm frozen fruit - the secret is corn sweeteners.**

Beery, K. E.

*Food Product Development* 12 (8) 76 (1978) [En]  
[ADM Corn Sweeteners, Cedar Rapids, Iowa, USA]

Improved fruit integrity and texture have been attained using 100% corn sweeteners for 'capping' fruit before freezing, instead of using sucrose. Capping is intended to preserve colour and by preventing oxidation, maintain the flavour. ADM Corn Sweeteners has been working with frozen strawberries capped with 100% CornSweet 55 and with the following % combinations of CornSweet 55 and 42 DE corn syrup (70/30, 50/50, 30/70 and 20/80 resp.). Results are tabulated for cost/cwt, savings compared with 100% sucrose, savings/10 million lb and strawberry integrity. In addition to improved fruit quality and a clearer syrup containing fewer fruit fragments, considerable savings can be attained. The greatest saving was obtained with the 20/80 combination of CornSweet 55/corn syrup. Reasons for the improvement in fruit quality are discussed. VJG

## 63

**Non-sucrose changes during sugar processing.** (In 'Proceedings of the 1978 Technical Session on Cane Sugar Refining Research' [see FSTA (1979) 11 12L784]) [Lecture]

Morel du Boil, P. G.; Schäffler, K. J.

pp. 107-135 (1979) [32 ref. En] [Hulett's Sugar Ltd, PO Mount Edgecombe, South Africa]

Non-sucrose impurities, mainly glucose and fructose, enter the mill in cane, varying with var. and season, and are also formed during processing by hydrolysis, decomposition and isomerization. Loss of glucose is a major factor, giving fructose:glucose ratios > 1.0. Pol measurements are only estimates of sucrose, due to errors introduced by various optically active

compounds. A new GLC procedure using silyl and oxime derivatives (details in appendix) which gives highly accurate estimations of sucrose, glucose and fructose was applied over 1 season to evaporator syrups and final molasses at 2 South African mills. Additional analyses were made of refractometer Brix, pol, reducing substances, non-fermentable reducing substances, amino-N, chlorides and sucrose. Precision of the new method was sucrose 0.6%, fructose or glucose 2%. Details are given of seasonal levels of non-sucrose components and fructose:glucose ratios; the ratio always increased between syrup and molasses and reached a peak in Oct. Reducing substances other than fructose or glucose also increased throughout the season and between syrup and molasses. Amino-N showed no seasonal trends but 30% was destroyed from syrup to molasses. Further loss of glucose occurred from molasses during storage. Relations between methods of sucrose estimation are studied, taking chromatography as the accurate reference. The Lane-Enyon method slightly overestimates sucrose, but is better than pol, which gives variable results due to glucose losses and analytical errors associated with lead acetate clarification. ELC

## 64

**[Kinetics of mutarotation of glucose solutions.]**

Gulyuk, N. G.

*Sakharnaya Promyshlennost'* No. 3, 51-53 (1979)  
[4 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

Mutarotation of glucose solutions was studied at various temp. An indicator of semi-mutarotation was applied, representing the period needed to reduce the angle of specific rotation to half; its relation to temp. was established. STI

## 65

**Fruits, flavors and the yoghurt industry.**

Grosskopf, J. C.

*American Dairy Review* 41 (5) 38-39, 51 (1979) [En]

Recent developments in the processing of fruit for flavouring yoghurt are discussed, including the use of high-fructose maize sweeteners, rather than sucrose, to 'cap' fruit prior to freezing with the advantage of improved protection against oxidation, use of vacuum-sealed bag-in-box containers and rapid freezing of the fruit, continuous processing with heating to  $\geq 190^\circ\text{F}$  in scraped-surface heat exchangers and aseptic packaging (giving in conjunction with a special 'oxygen barrier' plastics bags a shelf-life of  $\geq 1$  yr), use of pectin as a stabilizer, and finally various aspects of the quality of fruit supplies. FL





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FAB 20

USE OF GLUCOSE IN FOOD PRODUCTS

SELECTED FROM VOLUME **12**

FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

**under the direction of**

Commonwealth Agricultural Bureaux, Farnham Royal, Bucks; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublikaties en Landbouwdocumentatie (Pudoc), Wageningen.





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Titles of the FABs now available are given on the back cover of this booklet. For up-to-date lists of FABs or suggestions for new topics please write to the address on the back cover. New subjects are searched for at least the five most recent volumes of Food Science and Technology Abstracts. Thereafter each FAB is updated monthly. Copies of each month's abstracts on any topic may be obtained as indicated on the back cover of this publication. At the end of each volume of up-dating, the abstracts are merged and made available as a separate supplement to the original FAB.

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Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

EDITOR





## 1

[Changes in granulometric composition of crystals of glucose of I and II products depending on the massecuite transport conditions.]

Gopchak, N. Ya.; Romankova, N. D.

*Sakharnaya Promyshlennost'* No. 3, 45-47 (1979) [Ru] [Opornyi Punkt NPO po Krakhmaloproduktam pri Verkhnedneprovskom Krakhmalopatochnom Kombinate, USSR]

Long transportation of massecuites has an unfavourable effect on the quality of glucose crystals, while the number of crystals of size 0.1 mm depends also on the kind of transport. Difficulties may be encountered; small crystals are drained away and glucose yield is reduced. STI

## 2

[Application of high-pressure liquid chromatography to analysis of some sugar factory products.]

Rydel, S.

*Gazeta Cukrownicza* 87 (4) 79-81 (1979) [7 ref. Pl, ru, en, de] [Inst. Przemyslu Cukrowniczego, Warsaw, Poland]

The method can be used to separate xylose, glucose, fructose, sucrose and raffinose; these can be quantitatively determined. The apparatus (Laboratory Data Control) has the following parameters: column 25 x 4.62 mm; stationary phase Spherisorb S5-NH, mobile phase acetonitrile: 0.01 M aqueous solution of acetic acid (80:20); flow speed 1.9 ml/min. The signals recorded refractometrically by means of a differential detector (16 x) are transferred into an integrator connected with a printing device, and are recorded on a tape; the amounts of individual saccharides are given in µg. Separation and quantitative detn. were made with model solutions, thick juice and molasses high in invert sugar. STI

## 3

**Enzymatic hydrolysis of cellulosic materials by *Sclerotium rolfsii* culture filtrate for sugar production.**

Shewale, J. G.; Sadana, J. C.

*Canadian Journal of Microbiology* 25 (6) 773-783 (1979) [33 ref. En] [Biochim. Div., Nat. Chem. Lab., Poona 411 008, India]

The hydrolysis of purified celluloses (cotton, Avicel, Cellulose-123, Solka Floc SW40) and cellulosic wastes (rice straw, sugarcane bagasse, wood powders, paper factory effluents) by *Sclerotium rolfsii* CPC 142 culture filtrate was studied. Factors which effect saccharification such as pH, temp., enzyme concn., substrate concn., end-product inhibition, adsorption, and inactivation of enzyme and particle size were studied. Virtually no inhibition (<3%) of cellulose hydrolysis by the culture filtrate was observed by cellobiose and glucose up to 100 mg/ml. Filter paper degrading enzymes (s) (but neither carboxymethylcellulase nor β-glucosidase) was adsorbed on cellulose. The n value (adsorption) in the *S. rolfsii* system was calculated to be 0.32 for Avicel P.H. 101 and 0.53 for alkali-treated (AT) rice straw indicating penetration of cellulase into AT rice straw. In batch experiments at 10% substrate level,

solutions containing 6 to 7%, 3.8 to 4.7%, 4.00 to 5.1% and 4.2 to 4.9% reducing sugars were produced in 24 to 48 h from AT rice straw, AT bagasse, alkali-peracetic acid treated mesta wood and paper factory sedimented sludge effluent, resp. The main constituent in the hydrolysate from cellulose was glucose with little or no cellobiose, probably due to the high cellobiase content in the culture filtrate. AS

## 4

[Sweetening agents in the food industry.] [Review] Zaorska, H.

*Przemysl Spozywczy* 33 (2) 45-50 (1979) [28 ref. Pl, ru, en, fr, de]

Aspects covered in this review include glucose-fructose syrup, isomerase, fructose and non-calorie sweeteners (e.g. aspartame, miraculin). Beet sugar is still considered the most economical sweetening agent in temperate climates. HBr

## 5

[Investigations of the Maillard reaction. XIV. Formation of aminoreductones from glucose and primary amines.] Untersuchungen zur Maillard-Reaktion. XIV. Bildung von Aminoreduktionen aus Glucose und primären Aminen.

Ledl, F.; Severin, T.

*Zeitschrift für Lebensmittel-Untersuchung und -Forschung* 169 (3) 173-175 (1979) [8 ref. De, en] [Inst. für Pharmazie & Lebensmittelchemie, Univ. München, Sophienstrasse 10, D-8000 Munich 2, Federal Republic of Germany]

Glucose and methylammonium acetate react in hot aqueous solution to give several products. From this reaction mixture 1-methylamino-2-hydroxy-propen-3-one can be isolated. In the same manner glucose reacts with butylammonium acetate to yield 1-butylamino-2-hydroxy-propen-3-one. These experiments demonstrate that under the conditions of the Maillard reaction aminoreductones are formed from glucose and primary amines. [See FSTA (1979) 11 5A374 for part XIII.] AS

## 6

[Antioxidant activity of methylene chloride extracts obtained from glucose-ammonia (1M + 8M) browning mixtures.]

Paik, H. D.; Kim, D.-H.

*Korean Journal of Food Science and Technology* 11 (2) 93-98 (1979) [30 ref. Ko, en] [Dep. of Food Tech., Coll. of Agric., Korea Univ., Seoul, S. Korea]

Methylene chloride extracts were obtained from a glucose-ammonia (1M + 8M) browning reaction mixture, heated at 100°C for 4 h; the molar ratio of the reactants and the reaction time were optimum for max. formation of pyrazines. Methylene chloride extracts and furfural (for comparison only) were added to edible rapeseed oil substrates, and the resulting substrates and the control were stored at 37.0 ± 1.0°C. Peroxide values (POV), thiobarbituric acid values (TBA-values) and acid values (AV) were determined regularly during a 34-day storage period. Antioxidant activity of the methylene chloride extracts and furfural was estimated on the basis of POV, TBA-value and AV development of the



substrates and the control. Results showed that methylene chloride extracts of glucose-ammonia (1M + 8M) browning reaction mixture possessed considerable antioxidant activity; furfural also showed some activity. [From En summ.] SP

## 7

### Side reactions of acid hydrolysis of sucrose.

Krol, B.

*Acta Alimentaria Polonica* 4 (4) 373-380 (1978) [14 ref. En, pl] [Inst. Chem. Tech. Zywnosci Politec., Lodz, Poland]

S sucrose solution (concentrated to 0.62 g/cm<sup>3</sup>) was adjusted to pH 1.3 with HCl and hydrolysed at 60 ± 1°C for ≤ 180 min. 2 other sucrose solutions, one more dilute and the other more concentrated than the above, were similarly hydrolysed. In a parallel study, solutions of fructose, glucose and an equimolecular mixture of fructose and glucose were maintained under conditions identical to those above. Samples, withdrawn at intervals, were examined for optical rotation and subjected to paper chromatography. Results after 50 min indicated that, under the conditions employed, glucose showed no changes in composition; fructose underwent condensation (the main products being fructopyranosylfructose, inulobiose, levanobiose and difructose anhydride); the fructose/glucose mixture interacted to produce fructosylglucose, fructopyranosylfructose and inulobiose; and sucrose underwent partial hydrolysis with formation of fructopyranosylfructose, fructosylglucose and traces of trisaccharides. Further studies of sucrose solutions indicated that hydrolysis was virtually complete after 120 min and that the fully hydrolysed solutions contained glucose, fructose, fructosylglucose, fructopyranosylfructose, inulobiose and traces of fructose anhydrides. The relative concn. of the various reaction products in the sugar solutions was also determined. JA

## 8

### Purification of 2-deoxy-2-dansylamido-D-glucose by affinity chromatography on a lectin-loaded agarose column.

Bessler, W.; Schindler, P.

*Experientia* 35 (10) 1292-1293 (1979) [8 ref. En] [Inst. für Mikrobiol. der Univ. Tübingen, Auf der Morgenstelle 28, D-74 Tübingen, Federal Republic of Germany]

A method is described for purifying 2-substituted derivatives of glucose and sterically related sugars by affinity chromatography on Con A-Sepharose. The method seems to be of fairly general applicability. AS

## 9

### Extracellular maltase of *Bacillus brevis*.

McWethy, S. J.; Hartman, P. A.

*Applied and Environmental Microbiology* 37 (6) 1096-1102 (1979) [34 ref. En] [Dep. of Bact., Iowa State Univ., Ames, Iowa 50011, USA]

Maltases play an important role in the industrial production of glucose syrups used by the food industry. The purpose of this study was to isolate a bacterium

that produced extracellular maltase (*Bacillus brevis* was chosen for study), maximize enzyme production and purify and characterize the maltase. AL

## 10

### Glucose production.

Dietrichs, H.; Sinner, M.; Opderbek, F.; Brachthäuser, K.-H. (Projektierung Chemische Verfahrenstechnik GmbH)

*United States Patent* 4 160 695 (1979) [En]

A process is described for the production of glucose from cellulose-containing vegetable raw material which can be disintegrated by steam pressure treatment and defibrination. IFT

## 11

### [Glucose isomerization.]

Japan, Agency of Industrial Science & Technology

*Japanese Examined Patent* 5 412 540 (1979) [Ja]

Process is described for the enzymic isomerization of glucose to fructose in the presence of a boric acid salt or an alcohol or phenol ester of boric acid. IFT

## 12

### [Manufacture of glucose from starch by amylases of *Corticium rolfsii*.]

Tachibana, S.; Sato, M.; Kaji, A.

*Journal of Japanese Society of Food Science and Technology [Nippon Shokuhin Kogyo Gakkaishi]* 25 (1) 22-28 (1978) [24 ref. Ja, en] [Tokushima Agric. High School, Akui-cho, Tokushima-shi, Tokushima-ken, Japan]

A crude glucoamylase preparation was obtained from a culture filtrate of *C. rolfsii* IFO 4878 when starch was used as carbon source. The preparation contained typical glucoamylase with optimum hydrolytic activity towards corn starch at pH 3.0. The enzyme was unusually acid stable; even after storage at pH 2.0 or 3.0 and 30°C for 24 h, 85% of the enzyme activity remained. Hydrolysis was about 100% when the crude enzymes acted on 40% corn starch together with bacterial α-amylase. The glucoamylase preparation may be suitable for manufacturing glucose from starch. AS

## 13

### [Hydrolysis of sucrose in soft drinks.] Hydrolyse von Saccharose in Erfrischungsgetränken.

Länzlinger, U.

*Brauerei-Rundschau* 90 (8) 180-181 (1979) [7 ref. De] [Brauerei A. Hürlimann AG, Zurich, Switzerland]

Contents of sucrose, glucose and fructose in 2 beverages were measured enzymically 3 h after bottling, and at various times during room temp. storage for 14 wk. Hydrolysis of sucrose proceeded in an apparently linear manner with time, the rate depending on beverage pH. Sucrose contents of 'Sinalco' (pH 3.5) and 'Sinalco-Cola' (pH 2.8) were 95.4 and 94.4% total sugars, resp., 3 h after bottling, and were 81.0 and 46.5% after 14 wk. Results explain differences in taste between stored and freshly bottled samples. DIH



## 14

**Heats of adsorption of small molecules on various forms of lactose, sucrose and glucose.**

Ehler, K. F.; Bernhard, R. A.; Nickerson, T. A.  
*Journal of Agricultural and Food Chemistry* 27 (5) 921-927 (1979) [11 ref. En] [Dep. of Food Sci. & Tech., Univ. of California, Davis, California 95616, USA]

The heats of adsorption (HoA) of a variety of organic compounds were determined by the gas chromatographic method on regular, anhydrous  $\alpha$ -lactose (r-lactose),  $\beta$ -lactose, anhydrous  $\alpha$ -D-glucose, and sucrose and compared with HoA previously determined for stable, anhydrous  $\alpha$ -lactose (s-lactose). r-Lactose showed greater HoA than s-lactose for all compounds studied except for formate esters. All compounds studied except the hydrocarbons showed larger HoA on  $\beta$ -lactose than on s-lactose. HoA on  $\beta$ -lactose were generally greater than those on r-lactose. Sucrose showed much lower HoA than the 3 lactoses. Anhydrous  $\alpha$ -D-glucose generally showed greater HoA than s-lactose and were of the same order as those for r- and  $\beta$ -lactose. The bonding mechanisms appear to be similar to those proposed for s-lactose. Gibbs energies and entropies were calculated for all lactose reactions studied. AS

## 15

**Glucose syrups and related carbohydrates derived from wheat. [Lecture]**

Knight, P. K.

*IFST Proceedings* 12 (3) 147-150 (1979) [En]

Production of glucose syrups from wheat starch, and uses of products of wheat starch hydrolysis are discussed. Acidified slurry is forced down 'Kroyer' tubes which shear starch suspensions pressing between heated surfaces. The semi-gelatinized slurry is then treated with  $\alpha$ -amylase and amyloglucosidase to give syrups of 94-96 DE. Syrups are normally concentrated to 80% solids in a double effect evaporator, and are used in brewing and for caramel manufacture. A spray-drying technique is used to produce 'Trudex' a mixture of  $\alpha$ - and  $\beta$ -anhydrous dextrose, which has the ability to form solid crystalline masses from conc. solutions or slurries at ambient temp. Solid fudges may thus be produced from a variety of liquids. [See FSTA 12 3M283.] DIH

## 16

**Starch hydrolysate having less than 5 p.p.m. of heavy metals.**

Enokizono, S.; Kamata, N.; Kanno, S. (CPC International Inc.)

*United States Patent* 4 165 240 (1979) [En]

A dextrose-containing solution is treated with chelating resin capable of removing heavy metals and thereafter at least a part of the dextrose is isomerized to levulose in the presence of a dextrose isomerase enzyme preparation. AS

## 17

**Mass-transfer effects on the rate of isomerization of D-glucose into D-fructose, catalyzed by whole-cell immobilized glucose isomerase.**

Boersma, J. G.; Vellenga, K.; Wilt, H. G. J. de; Joosten, G. E. H.

*Biotechnology and Bioengineering* 21 (10) 1711-1724 (1979) [22 ref. En] [Chem. Eng. Lab., Univ. of Groningen, 9747 AG Groningen, Netherlands]

In connection with the development of an immobilized enzyme system intended for use in the commercial production of high fructose syrup from glucose, consideration is given to: the structure of the catalyst particle; a model description of the overall reaction (particularly external and internal mass transfer); and the intrinsic kinetics of the reaction. The catalyst system consists of immobilized *Arthrobacter* cells containing glucose isomerase which catalyses the isomerization of glucose into fructose. On the basis of electron microscope photographs of freeze-etched catalyst, a porous sphere model was proposed for the internal structure of the catalyst; this model was used to describe the reaction. It appeared that, under normal operating conditions, the external mass transfer rate does not influence the overall rate of reaction. The effect of internal mass transfer resistances on the overall reaction rate could be accounted for by the porous sphere model. The intrinsic kinetics of the isomerization reaction could be represented by a modified Michaelis-Menten equation for a reversible one-substrate reaction. JA

## 18

**High fructose corn syrup; an important new sugar substitute.**

Thor, P. K.; Carman, H. F.

*California Agriculture* 33 (7/8) 13-15 (1979) [En]

High fructose corn syrup (HFCS) is a clear, sweet, low viscosity liquid, high in simple sugar fructose, is hygroscopic, and can be substituted for sucrose in all products that do not require a crystalline structure. Its manufacture, using immobilized enzyme technology, its industrial use, industrial processing capacity of HFCS, pricing of HFCS and its market potential are discussed. SP

## 19

**[Effects of multivalent cations on the enzymic determination of glucose using glucose oxidase.]** Zum Einfluss mehrwertiger Kationen auf die enzymatische Bestimmung von Glucose mit Glucoseoxydase.

Krause, W.

*Nahrung* 23 (7) 715-721 (1979) [15 ref. De, en, ru]

[Sektion Chem., Wissenschaftsbereich Lebensmittelchem. & Tech. Biochem., Tech. Univ., Dresden, German Democratic Republic]

$\text{Fe}^{3+}$  and  $\text{Cu}^{2+}$ , at concn.  $> 10^{-4}\text{M}$ , inhibit the indicator reaction of a glucose oxidase/peroxidase reagent for the enzymic detn. of glucose, when weakly complexing buffers or buffer-free reaction media are used. The addition of EDTA and other complexing agents or, time-dependently, the buffer ions themselves reverses the inhibition to a great extent. The discussed mechanism of inhibition is based on the assumption that the metal ions share in the re-oxidation of the co-enzyme of glucose oxidase. Studies on other metal ions show  $\text{Hg}^{2+}$  to be strongly inhibitory, and  $\text{As}^{3+}$  and  $\text{Zn}^{2+}$



to be weakly inhibitory.  $Mg^{2+}$ ,  $Ca^{2+}$ ,  $Mn^{2+}$ ,  $Pb^{2+}$  and  $Ni^{2+}$  were not inhibitory. Use of buffers capable of efficient masking of metal ions (tris or phosphate buffer) is recommended. IN

## 20

**[Enzymic determination of glucose and sucrose in selected dietetic foods.]** Zur enzymatischen Bestimmung von Glucose und Saccharose in ausgewählten diätetischen Lebensmitteln. Hübner, D.; Schäfer, R.; Pietsch, H.-P. *Nahrung* 23 (7) 723-729 (1979) [8 ref. De, en, ru] [Bezirks-Hygieneinspektion & -inst. Dresden, German Democratic Republic]

An enzymic procedure for detn. of glucose and sucrose in dietetic foods is described, based on the Fermognost blood sugar test (a glucose oxidase/invertase/ $\alpha$ -dianisidine procedure); sucrose is hydrolysed with invertase before detn. Some foods may need decoloration or elimination of fat or protein before testing. Results determined by this enzymic procedure were compared with those determined by the Luff-Schoorl method; a table of results is given for 9 dietetic foods and 4 calorie-reduced foods. The enzymic procedure was found to give considerably lower values than the Luff-Schoorl procedure: this is due to interference of other food constituents (especially other sugars and starch hydrolysates) in the Luff-Schoorl procedure. IN

## 21

**Preparation and nutritional properties of caseins covalently modified with sugars. Reductive alkylation of lysines with glucose, fructose, or lactose.**

Lee, H. S.; Sen, L. C.; Clifford, A. J.; Whitaker, J. R.; Feeney, R. E.

*Journal of Agricultural and Food Chemistry* 27 (5) 1094-1098 (1979) [27 ref. En] [Dep. of Food Sci. & Tech., Univ. of California, Davis, California 95616, USA]

Reducing sugars were attached to the  $\epsilon$ -amino lysyl residues of casein in the presence of sodium cyanoborohydride, forming stable amine linkages. At pH 8.0 and 37°C for 120 h in the presence of 1000 molar excess of sugar, the degree of modification was 80% with glucose, 62% with fructose, and 17% with lactose. Compared to native casein, these reductively formed sugar derivatives of casein were shown to have lower in vitro digestibility by  $\alpha$ -chymotrypsin and lower nutritive values in rat feeding experiments. Severe growth depression was observed in rats fed with the glucose-derivatized casein. Addition of lysine to the diet containing glucose-derivatized casein (71% modified) partially alleviated the growth-depressing effects. Moderate growth depression was observed in rats fed with the fructose-derivatized casein or with the lactose-derivatized casein. Since these 3 derivatives were not equally modified, the observed rat growth responses may be due to the decreased availability of modified lysine as well as to the nature of the attached sugar. AS

## 22

**Maltose production.**

Maeda, H.; Tsao, G. T.

*Process Biochemistry* 14 (7) 2, 4-5, 27 (1979) [19 ref. En] [Fermentation Res. Inst., Agency of Ind. Sci. & Tech., Min. of Int. Trade & Ind., Japan]

Production of maltose syrups from starch, and properties of such syrups, are discussed. 2 types of syrups are considered; (i) high maltose syrup contains 30-50% maltose + 6-10% glucose, 43-49 DE, whereas (ii) fermentable syrup contains 30-40% maltose + 30-50% glucose, 65-70 DE. (i) syrups are popular for sweetening cakes, beverages, etc. in Japan, and (ii) are useful in brewing and breadmaking. (i) syrups are produced by the acid-enzyme conversion process (starch slurry is acidified, subjected to high pressure and temp., then neutralized, cooled, and treated with, e.g. barley  $\beta$ -amylase until required maltose content is reached) or by the multiple enzyme process (starch is gelatinized, given a preliminary treatment with fungal or bacterial  $\alpha$ -amylase, then barley  $\beta$ -amylase is added). The latter process is the more common in Japan. (ii) syrups are produced by preparing a starch slurry of 20-25°Baume, acid or enzymic treatment to give 15-20 DE, adjusting to pH 4.5-5.9 with solids content of 20-55% and saccharifying with a mixture of fungal  $\alpha$ -amylase, barley  $\beta$ -amylase and refined glucoamylase until required DE is reached. Potential future developments include use of new microbial  $\beta$ -amylases, use of microbial pullulanase, and immobilization of enzymes on supports such as cellulose beads. Hydrolysis kinetics are illustrated graphically and composition of a variety of corn syrups with differing DE and % maltose are tabulated. DIH

## 23

**[Formation of organic acids during decomposition of glucose in alkaline medium.]**

Urkisa, Kh. M.; Rodrigus, M. M.; Bobrovnik, L. D.

*Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya* No. 2, 35-36 (1979) [9 ref. Ru] [Univ. Las-Villas, Cuba]

Decomposition of glucose in pure 0.125M solutions at pH 11 and temp. of 30°, 60° and 80°C was studied in relation to presence of  $Ca^{2+}$ . Higher temp., as well as presence of  $Ca^{2+}$ , accelerated decomposition of the glucose and formation of acids, whereas intensity of the reactions leading to formation of colouring substances declined. Glucose decomposed to lactic, citric, hydroxyacetic, malic, succinic, aconitic, and oxalic acids. STI

## 24

**Fluidized-bed immobilized-enzyme reactor for the hydrolysis of cornstarch to glucose.**

Allen, B. R.; Charles, M.; Coughlin, R. W.

*Biotechnology and Bioengineering* 21 (4) 689-706 (1979) [8 ref. En] [Dep. of Chem. Eng., Lehigh Univ., Bethlehem, Pennsylvania 18015, USA]

Experimental studies with the reactor are reported, particular consideration being given to catalyst preparation, studies of reactor performance and a



preliminary economic evaluation of the process. Various catalyst preparation techniques, support materials and enzyme sources were examined in an attempt to find a highly active, stable, low cost catalyst. A schematic diagram of the complete reactor system is included. Results obtained indicated that a glucoamylase-on-alumina (covalently bonded) catalyst is inexpensive, has a high initial activity 130 units/g and excellent long-term stability. The reactor gives higher dextrose yields from streams containing approx. 30% (by wt.) low DE cornstarch than a comparable fixed-bed reactor because its design exploits the fact that fluidization permits use of very small catalyst particles (down to 50  $\mu\text{m}$ ) which overcomes the yield-limiting, diffusion-associated problems encountered with fixed-bed reactors; also the fluidized-bed reactor does not suffer from plugging and high pressure drop problems associated with fixed-bed reactors. Economic analysis with a bench-scale reactor indicated that the cost of saccharifying low DE cornstarch is  $\leq 33\%$  lower with the fluidized-bed reactor process than with a conventional soluble-enzyme process. JA

## 25

[Mutarotation of concentrated solutions of glucose.] Gulyuk, N. G.

*Sakharnaya Promyshlennost'* No. 7, 40-41 (1979) [3 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

A new methodology for establishing the effect of a high concn. of glucose on the kinetics of mutarotation in supersaturated aqueous solutions of glucose depends on preparing a high-concn. (around 80%) solution of glucose by dissolving it at high temp. The specific rotation is constant in such solutions. Rapid dissolution of glucose at a constant temp. provide an unsaturated solution (35%) in which mutarotation takes place. If both solutions are mixed, a supersaturated solution of glucose is obtained, with a given concn. In this process, part of the  $\alpha$ -glucose turns into the  $\beta$ -form, which modifies the angle of rotation of the polarized light plane for the supersaturated solution. On the basis of this methodology, solutions were prepared with 83% and 35% DM content; by blending at 40°C (1.5:1) a solution with 64% DM results. Graphical analysis was used to determine the semi-rotation time; this was  $390 \pm 20$  s for the 2 solutions. It follows that glucose concn. is not significant for the kinetics of mutarotation of solutions. At 35% concn. the specific rotation of the  $\alpha$ -form is 53.5°; and 55.6° and 57.4° for 64% and 84%, resp. STI

## 26

Glucose analysis utilizing immobilized enzymes.

Keyes, M. H.; Semersky, F. E.; Gray, D. N. *Enzyme and Microbial Technology* 1 (2) 91-94 (1979) [12 ref. En] [Owens-Illinois, Inc., North Tech. Cent., PO Box 1035, Toledo, Ohio 43666, USA]

4 commercially available instruments for measuring glucose concn. with immobilized enzymes are described. 3 are designed for clinical applications, and 1, made by Leeds & Northrup, is designed for industrial food processing applications. This latter instrument continuously samples a moving stream; sample is passed through a column of immobilized glucose

oxidase, and  $\text{H}_2\text{O}_2$  generated is detected by a potentiostatic 3-electrode system. Precision is 1% for 0-50 p.p.m. Other enzymes/enzyme systems are available for detn. of sucrose or lactose. DIH

## 27

[Glucose-fructose isomerization.]

Nisshin Sugar Manufacturing Co. Ltd.

*Japanese Examined Patent* 5 424 472 (1979) [Ja]

Process is described for continuous isomerization of glucose to fructose at a high conversion rate which employs glucose isomerase having a high specific activity. IFT

## 28

[Isoglucose, a new food-grade sweetener.]

Amato, P.

*Industria Alimentari* 18 (9) 635-637 (1979) [13 ref. It] [Istituto di Merceologia, Univ. di Napoli, Naples, Italy]

## 29

[Centrifugation of glucose massecuites from product II in the FPN-1251L-2 separator.]

Gopchak, N. Ya.; Romanyukha, N. D.; Bondar', E. G. *Sakharnaya Promyshlennost'* No. 7, 39-40 (1979) [Ru] [Oporny Punkt NPO po Krakhmaloproduktam, USSR]

In 1978, the automatic separator FPN 1251L-2 was first used in starch manufacture; it differs from the PN-1000 in that its capacity is higher, there are more working speeds and the operations are programmed. There is no closing cone, which has been replaced by a disc cam. The centrifuging time and the quality of yellow sugar depend on the initial massecuite quality. Capacity of the FPN-1251L-2 separator is 11.75-15.0 t/day (converted to glucose with 91% DM); capacity of the PN-1000 separator was 3.68-5.0 t/day. STI

## 30

Growth limitation of *Pseudomonas* spp. by glucose. Barua, M.; Shelef, L. A.

*Abstracts of the Annual Meeting of the American Society for Microbiology* 79, 215 (1979) [En] [Wayne State Univ., Detroit, Michigan 48202, USA]

The effect of glucose on growth of 2 Shewan's group II pseudomonads at 5 and 22°C was studied. In the absence of glucose, a growth level of approx.  $10^9$  cells/ml was reached in nutrient broth after approx. 7 days of incubation. It was accompanied by pH elevation, high turbidity, slime formation and off-odours. In the presence of glucose at concn. of 0.5 to 10% by wt., growth lag and growth level were decreased. Total growth was reached after 2-4 days, and its value decreased as the glucose concn. in the medium increased. The medium pH dropped by up to 2 units within the first 2 days of incubation, colony size was small, turbidity was low, and slime and off-odours were absent. Lysis of cells was visible in media with the high carbohydrate concn. Glucose assay showed that the depleted amounts were proportional to the substrate concn. in the medium: at concn. of  $\geq 1\%$  both strains utilized an average of 11.3% of the available



glucose, most of it during the first 2 days of incubation. Acid production also increased with increase in glucose concn. Although the effect of glucose lessened in buffered medium of pH 6.3, growth declined in a similar manner with the increase in glucose concn. These results imply possible alteration of the meat spoilage pattern by the addition of glucose. AS

### 31

**Storage quality of dark, firm, dry meat.**

Newton, K. G.; Gill, C. O.

*Applied and Environmental Microbiology* 36 (2) 375-376 (1978) [7 ref. En] [Meat Ind. Res. Inst. of New Zealand (Inc.), Hamilton, New Zealand]

Studies were conducted to evaluate the significance of glucose concn. for the keeping quality of dark firm dry (DFD) meat; in the absence of glucose, pseudomonads may degrade amino acids, with the production of  $\text{NH}_3$  and off-odours. Samples of DFD beef striploin were used in experiments; data are given for pH and glucose concn. Meat slices (pH 6.3, devoid of glucose) were treated with L-lactic acid to adjust pH to 5.6, or with glucose solution to give a glucose concn. of about 100  $\mu\text{g/g}$  wt. These and controls of high pH (pH 6.3, no glucose) and intermediate pH meat (pH 5.85, 112  $\mu\text{g}$  glucose/g wet wt.) were inoculated with a fluorescent *Pseudomonas* isolate from spoiled meat and incubated at 10°C under humid aerobic conditions. Lag phase increased with decreasing pH, but there was little difference in growth rate between the various samples. Off-odours were detected in glucose-free samples after 2 days, vs. 4 days for glucose-containing samples. In a further study, muscle samples (devoid of glucose) from sheep exercised to exhaustion before slaughter were inoculated with *Pseudomonas* sp., incubated, and examined for  $\text{NH}_3$  formation at the inoculated surface. The results show detectable  $\text{NH}_3$  formation when the bacterial count reached  $10^9/\text{cm}^2$ , vs.  $\text{NH}_3$  formation only at counts  $> 10^8/\text{cm}^2$  for normal (glucose-containing) mutton. It is concluded that glucose concn. is a critical factor for the keeping quality of DFD meat. AJDW

### 32

**[Analysis of starch and starch products.**

**Determination of D-glucose and D-fructose in the same sample. Enzymic method.]** Untersuchung von Stärke und Stärkeerzeugnissen. Bestimmung von D-Glucose und D-Fructose in derselben Untersuchungsprobe. Enzymatisches Verfahren. Germany, Federal Republic of, Deutscher Normenausschuss

*German Federal Republic Standard* DIN 10 381, 3pp. (1979) [De]

An enzymic method for detn. of D-glucose and D-fructose in a single sample of a starch hydrolysate is described. The 2 sugars are phosphorylated to glucose-6-phosphate (G-6-P) and fructose-6-phosphate (F-6-P) resp. by hexokinase in the presence of ATP. The G-6-P is oxidized to gluconate-6-phosphate by means of G-6-P dehydrogenase and NADP; the quantity of NADPH formed is proportional to the G-6-P concn., and may be determined by spectrophotometry at 340 nm. F-6-P is then converted to G-6-P by means of G-6-P isomerase, and determined as above. AJDW

### 33

**Acid hydrolysis of cellulose to yield glucose.**

Tsao, G. T.; Ladisch, M. R.; Bose, A. (United States of America, Purdue Research Foundation)  
*United States Patent* 4 174 976 (1979) [En]

Cellulose is recovered from cellulosic materials, preferably by pretreatment involving dissolving in Cadoxen or a chelating metal caustic swelling solvent, and precipitation of the cellulose. Hydrolysis is accomplished using an acid, preferably dilute, and the glucose is yielded substantially without side products. Lignin may be removed either before or after hydrolysis. HBr

### 34

**Kinetics of reactions with amyloglucosidase and their relevance to industrial applications.**

Roels, J. A.; Tilburg, R. van

*Stärke* 31 (10) 338-345 (1979) [6 ref. En, de]

Kinetic studies with industrial amyloglucosidase (AMG) (Gist Brocades' Maxydrase) and 15% DE dextrin or glucose substrates at 10-40% w/w showed the equilibrium constants for degradation of  $\alpha$ -1,6 and  $\alpha$ -1,4 bonds in native starch to be significantly different. This results in resynthesis (by reverse reaction) especially of isomaltose if highly conc. dextrin solution are incubated with AMG, which has a high  $\alpha$ -1,6 splitting activity (equilibrium constant K for hydrolysis of  $\alpha$ -1,6 bonds is 0.6, vs. 3.5 for  $\alpha$ -1,4 bonds). Models of the degradation of dextrans by AMG were able to account for the known transient top in DE on incubation. Top DE decreased with increasing  $\alpha$ -1,6 splitting activity of the enzyme preparations, especially at higher DM. In immobilized AMG the reverse reaction (resynthesis) was apparently more active than the degradation reaction, due to diffusion resistance. In simulation, this lowered top DE values. These problems are less significant in dilute dextrin solutions. The studies reveal the existence of an optimal incubation time (dependent on enzyme dose, DM concn. and temp.) for max. DE value, which is highly significant at industrial concn. of 30-40% DM. RM

### 35

**Rapid determination of dextrose equivalent by cryoscopy.**

Fitton, M. G.

*Stärke* 31 (11) 381-384 (1979) [En, de] [CPC Europe Ind. R & D Cent., Havenstraat 84, B-1800 Vilvoorde, Belgium]

A novel method is described for detn. of the dextrose equivalent (DE) of malto dextrans and glucose syrups, based on depression of the f.p. as a measure of molecules in solution. (Detn. of DE by titration i.e. the Lane-Eynon DE, is also a measure of the number of molecules in solution). The advantages of the cryoscopic method are its speed (2 min/detn.), precision and the fact that no prior training is required. Very good agreement was obtained in DE detn. of 2 glucose syrups by 8 operators (max. variation between operators 0.4 DE), and in comparison with titrimetric results for a series of samples of 3.5-100% DE (max. variation 1.0 DE). RM



36

## [Glucose-fructose isomerization.]

Mitsubishi Chemical Industry Co. Ltd.

*Japanese Examined Patent* 5 439 472 (1979) [Ja]

A process is described in which glucose is isomerized to fructose using glucose isomers in the presence of Mg and Fe ions. IFT

37

## [Action of glucose isomerase on oligosaccharides in starch hydrolysates.] Die Wirkung von Glucoseisomerase auf Oligosaccharide in Stärkehydrolysaten.

Boruch, M.; Nebesny, E.

*Stärke* 31 (10) 345-347 (1979) [9 ref. De, en] [Tech. Univ., Inst. für Lebensmitteltechnologie, Sta. Gdanska 162/168, 90-924 Lodz, Poland]

Continuous glucose isomerization by glucose isomerase was studied, using solutions of pure glucose (DE 100%), 45% DE starch hydrolysate, 31% DE glucose-free starch hydrolysate and pure maltose. The studies showed that under certain conditions the enzyme was active not only against glucose but also against oligosaccharides in starch hydrolysates. The effect was increased at low glucose concn. It was shown that glucose isomerase converted small amounts of maltose to an unidentified ketodisaccharide, and formed ketose units in maltooligosaccharides. The effect on maltose and maltooligosaccharides was particularly pronounced in glucose-free or low glucose solutions. RM

38

## [Simultaneous determination of fructose, glucose and sucrose by the anthrone reaction.] Gleichzeitige Bestimmung von Fructose, Glucose und Saccharose mit der Anthron-Reaktion.

Abidin, I.; Maier, H. G.

*Chemie Mikrobiologie Technologie der Lebensmittel* 6 (4) 121-123 (1980) [10 ref. De, en] [Inst. für Lebensmittelchemie der Tech. Univ. Braunschweig, Brunswick, Federal Republic of Germany]

The sum of fructose, glucose and sucrose (the last calculated as hexose) may be determined in foods by a special modification of the reaction with anthrone/sulphuric acid. All 3 sugars exhibit the same molar extinction (related to hexose) at 605 nm. This is also true for sugars bound to fruit acids. The s.d. lies near  $\pm 0.5 \mu\text{g/ml}$ . Absorption is practically constant within 15 min at room temp. Free malic, citric and tartaric acids augment this value, if present in excess. AS

39

## [Trials on glucose oxidation in glucose-fructose mixtures by immobilized glucose oxidase and catalase.] Versuche zur Glucoseoxidation in Glucose-Fructose-Gemischen mittels fixierter Glucoseoxidase und Katalase.

Hartmeier, W.; Tegge, G.

*Stärke* 31 (10) 348-353 (1979) [12 ref. De, en] [CH Boehringer Sohn, D-6507 Ingelheim, Federal Republic of Germany]

An enzyme preparation of glucose oxidase with

excess catalase from *Aspergillus niger* was fixed with glutardialdehyde to particles of gelatin hardened with formaldehyde. Activity and stability characteristics of the preparation are given as functions of pH, temp. and substrate concn. The data are discussed with a view to industrial application. Basic trials on application were done in 4 different reactor types, i.e.: an aerated stirred reactor; packed bed reactor coupled with stirred reactor; stirred reactor with  $\text{H}_2\text{O}_2$ ; and stirred reactor with recycling of enzyme particles from reactor head. Highest glucose conversion rates were obtained with  $\text{O}_2$  supplied by  $\text{H}_2\text{O}_2$ , but the  $\text{H}_2\text{O}_2$  caused rapid decrease in enzyme stability. Encouraging results for possible industrial application were obtained with a specially constructed aerated stirred tank with reaction temp.  $< 10^\circ\text{C}$ ; no significant difference was observed between enzyme activity at  $30^\circ$  or at  $2^\circ\text{C}$ , while stability was much improved. RM

40

## The effect of calcium ions on the hydrolysis of starch.

Sukan, G.; Kearsley, M. W.; Birch, G. G.

*Stärke* 31 (4) 125-128 (1979) [25 ref. En, de] [Nat. Coll. of Food Tech., St. George's Avenue, Weybridge, Surrey, UK]

The ability of raw and dioxan extracted maize and potato starches to bind Ca is shown to influence the in vitro digestibility of the starches by pancreatic  $\alpha$ -amylase. The in vitro digestibility of commercial and fractionated glucose syrups in the presence of Ca is also described. While the extraction process improves the digestibility of both maize and potato starch, addition of Ca lowers the digestibility of raw maize starch but increases the digestibility of raw and extracted potato starch. When raw and extracted maize and potato starches are converted to glucose syrup by acid hydrolysis, no differences are found in the reducing capacities of the syrups. (The different in vitro patterns of  $\alpha$ -amylase hydrolysis are not yet applicable to in vivo digestion, where different time/pH factors are involved.) AS

41

## [Thermally modified starch as a substrate for saccharification of starch to glucose by glucoamylase.] Thermisch modifizierte Stärke als Substrat für die Stärkeverzuckerung mittels Glucoamylase.

Sroczynski, A.; Boruch, M.; Pierzgański, T.

*Stärke* 31 (4) 129-133 (1979) [15 ref. De, en] [Tech. Univ., Inst. für Lebensmitteltech., ul Gdanska 162/168, 90-923 Lodz, Poland]

Thermal modification of starch was effected in a pneumatic apparatus by fast heating to about  $200^\circ\text{C}$ , followed by fast cooling. A swollen starch was obtained which gelatinizes at room temp. Optimum conditions of thermal treatment were:  $200\text{--}230^\circ\text{C}$ ; 20% moisture starch; starch:hot air ratio  $40\text{--}50 \text{ g/m}^3 \text{ h}$ ; length of heating to  $230^\circ$  and subsequent cooling to  $20^\circ\text{C}$ , 1-2 s. Both viscosity and bulk wt. are greatly reduced and the product is partly soluble in cold water. The saccharification is similar to that of the enzyme-enzyme process (bacterial  $\alpha$ -amylase) and better than that of the acid-enzyme process. RM



## 42

**Specification for glucose syrup.**

Barbados, Barbados National Standards Institution  
*Barbados National Standards* BNS 104: 1978, 5pp.  
 (1978) [En]

This standard applies to quality requirements, analytical methods and sampling of glucose syrup, a purified conc. aqueous solution of nutritive saccharides obtained from starch. Specific requirements include: contents of TS  $\geq 70\%$  m/m, reducing sugar (DE expressed as D-glucose on a dry basis)  $\geq 20\%$  m/m, sulphated ash (on dry basis)  $\leq 1.0\%$  m/m, SO<sub>2</sub>  $\leq 40$  mg/kg, SO<sub>2</sub> in glucose syrup (for manufacture of sugar confectionery only)  $\leq 400$  mg/kg, As  $\leq 1$  mg/kg, Cu  $\leq 5$  mg/kg, and Pb  $\leq 2$  mg/kg. KME

## 43

**Studies on whole cell immobilized glucose isomerase. II. Operational studies on the batchwise and continuous isomerization of D-glucose.**

Ahn, B. Y.; Byun, S. M.

*Korean Journal of Food Science and Technology* 11 (4) 249-257 (1979) [22 ref. En, ko] [Dep. of Biol. Sci. & Eng., Korea Advanced Inst. of Sci., Seoul, S. Korea]

The whole cell immobilized glucose isomerase (GI) prepared in part I [see FSTA (1980) 12 6L402] was used to isomerize D-glucose in a batch reactor (continuous stirred tank type) and a continuous reactor (plug-flow packed bed type). The operations involved in isomerization are detailed for each reactor. Operational studies were made of the 2 reactors, including detn. of the flow characteristics and voidage of the packed bed reactor, measurement of the specific activity and operational stability of the enzyme, detn. of the apparent Michaelis-Menten constants and studies of the effect of enzyme and substrate concn. on productivity. Results, presented in graphs and tables, included the following. The specific activity of GI was 48 units/g in the batch reactor and the observed equilibrium conversion was approx. 48%. In the continuous reactor, the specific activity was found to be affected by flow rate, substrate concn., packaging density and reactor geometry but a mean value of 114 units/g was obtained. The equilibrium conversion in the continuous reactor was 55%. The half-life of GI activity was calculated to be approx. 115 days. Further studies are recommended. JA

## 44

**Continuous chromatographic separation of fructose/glucose.**

Hirota, T.

*Sugar y Azucar* 75 (1) 245-247 & 359-361 (1980) [En, Es] [Mitsubishi Chem. Ind. Ltd., 5-2, Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan]

A brief discussion is given of studies on large-scale continuous separation of fructose from glucose by chromatography. Aspects considered include: chromatographic separation methods; the Mitsubishi Chemical Industries method; studies on a simulated moving-bed separation method (covering selection of separation agent, fractionation ability and pressure drop); the life of the separating agent; optimization of

design and operation factors (covering temp., raw material concn., separation medium load and number of packed beds); scale-up of the separation system; simulation model of the Mitsubishi system; and operational results of a pilot plant based on the Mitsubishi system. AJDW

## 45

**[Enzymic treatment of whey with recovery of the enzyme by ultrafiltration.]**

Norman, B. E.; Severinsen, S. G.; Nielsen, T.; Wagner, J. *Nordeuropaeisk Mejeri-Tidsskrift* 44 (5/6) 129-136 (1978) [Da, Fr, De] [Novo Industri A/S, Novo Alle, DK-2880 Bagsvaerd, Denmark]

Novo Industri A/S and De Danske Sukkerfabrikker have jointly developed a batch process in which the lactose in ultrafiltration permeate from milk or whey is split into galactose and glucose by the enzyme Lactozym 750L, a purified lactase obtained from *Kluyveromyces fragilis*. The substrate is then separated by ultrafiltration to recover the enzyme, which may be reused. Although the enzyme operates best at 40-50°C and pH 6.5-7.0, these conditions favour unacceptable bacterial growth. To minimize the risk of bacterial growth, a low-temp. hydrolysis process (5°C) was therefore developed using batches of 1500 l and 22 h reaction time. The process may be used to produce glucose-galactose syrups with 70, 80 or 90% lactose hydrolysis (at costs of 1.79, 1.88 and 2.08 kr/kg DM, resp., assuming an annual output of 5378 t DM). Alternatively, it may be used to produce low-lactose milk, at a cost of 98.80 kr/m<sup>3</sup> milk when lactose content of 25 000 t milk/yr is reduced from 4.5 to 1.3%. In the latter process, the proteins are first removed by ultrafiltration, the permeate is then treated with the enzyme, and after recovery of the enzyme by a 2nd ultrafiltration, the permeate is recombined with the proteins. ADL

## 46

**The factors determining the poor keeping qualities of DFD meat. [Lecture]**

Gill, C. O.; Newton, K. G.

*Proceedings of the European Meeting of Meat Research Workers* No. 24, A4:1-A4:5 (1978) [3 ref. En, de, fr, ru] [Meat Ind. Res. Inst. of New Zealand (Inc.), Hamilton, New Zealand]

Beef striploins graded as DFD (dark, firm, dry) were obtained from a local abattoir. Mean pH and glucose contents in *longissimus dorsi*, *multifidus dorsi* and *longissimus costarum* muscles from 18 striploins were, resp.: pH, 5.67, 5.97 and 6.16; and glucose content, 62, 37 and 22 µg/g wet wt.; glucose was absent from all muscles with pH  $> 6.4$ , and absent from some muscles with pH as low as 6. Slices of meat of pH 6.3 and devoid of glucose (from the striploins or from mutton of high ultimate pH obtained from sheep exercised to exhaustion before slaughter) were treated with L-lactic acid to reduce pH to 5.6, or with glucose solution to give final glucose concn. of about 100 µg/100 g. These slices and controls were inoculated with fluorescent *Pseudomonas* sp. isolated from spoiled mutton, and incubated at 10°C under humid, aerobic conditions. Spoilage occurred more readily in samples devoid of



glucose, irrespective of pH, than in those containing glucose. Glucose content rather than pH is recommended for definition of the DFD condition. [See FSTA (1980) 12 8S1280.] SKK

## 47

#### Specification for dextrose anhydrous.

Barbados, Barbados National Standards Institution  
*Barbados National Standards* BNS 109, 5pp. (1978)  
[En]

Composition of dextrose anhydrous (purified and crystallized D-glucose without water of crystallization) shall be: D-glucose,  $\geq 99.5\%$  m/m (dry basis); TS,  $\geq 98\%$  m/m; and sulphated ash,  $\leq 0.25\%$  (dry basis).  $\text{SO}_2$  content shall be  $\leq 20$  mg/kg, and max. contaminants content As 1, Cu 2 and Pb 2 mg/kg. Methods of analysis and sampling are given. AL

## 48

#### [Determination of fructose, glucose and sucrose in foods.]

Fuchs, G.; Wretling, S.

*Var Föda* 31 (7) 435-439 (1979) [6 ref. Sv, en]  
[Näringslab., Statens Livsmedelsverk, S-751 26 Uppsala, Sweden]

Comparative studies were conducted on detn. of fructose, glucose and sucrose in foods by Boehringer-Mannheim enzymic techniques, and by GLC of trimethylsilyl derivatives. 25 samples, representing a wide range of food types, were analysed by the 2 techniques. Graphs are given showing the relation between values determined by the 2 techniques. Correlation coeff. for the 2 methods were  $r^2 = 0.99$  for fructose and  $r^2 = 1.00$  for both glucose and sucrose; differences in sugar concn. determined by the 2 methods were not statistically significant. It is concluded that both methods are suitable for routine detn. of sugars in foods. AJDW

## 49

#### Glucose isomerization.

Novo Industri A/S

*British Patent* 1 551 444 (1979) [En]

A process is described for isomerizing glucose to fructose, which employs an immobilized glucose isomerase in the presence of a soluble phosphate to increase productivity. IFT

## 50

#### [New method of preparation of first-cycle massecuites in the manufacture of medicinal glucose.]

Kmita, L. V.; Engel's, N. S.; Grinchenko, S. Ya.

*Sakharnaya Promyshlennost'* No. 8, 48-49 (1979) [Ru]  
[Verkhnedneprovskii Krakhmalo-patochnyi Kombinat, USSR]

An improved method of manufacture of highly purified (medicinal) glucose massecuite includes the following stages: a pre-heated granulator is  $\frac{1}{4}$  filled with syrup containing 66% DM, and 400 g of medicinal glucose (dry) is added as inoculum. When crystals have developed, another  $\frac{1}{4}$  of the granulator is filled with

syrup containing 66% DM. The vol. and density are allowed to reach a level suitable for centrifugal separation; the granulator is topped up with 68% DM syrup. The temp. of the syrup is 53-55°C. The massecuite is cooled to 45-40°C for 48 h. The massecuite thus obtained has the required properties. STI

## 51

#### [Accelerated manufacture of hydrated medicinal glucose.]

Gopchak, N. Ya.

*Sakharnaya Promyshlennost'* No. 9, 54-56 (1979) [Ru]  
[Oporny Punkt NPO po Krakhmaloproduktam pri Verkhnedneprovskom Krakhmalo-patochnom Kombinate, USSR]

Temp. patterns of crystallization of highly purified (medicinal) glucose are analysed to devise the resultant pattern; in this pattern the process time is reduced by 16-24 h; the yield and quality of crystals are satisfactory. Syrup with 72% DM is fed into the granulator at 50°C, and is mixed with 10% of starter to adjust the temp. to a fixed 46°C. The temp. decreases at a rate of 2°C/8 h in the granulator, but will not drop below 40°C. STI

## 52

Nutritive sweeteners made from starch. [Review]  
MacAllister, R. V.

*Advances in Carbohydrate Chemistry and Biochemistry* 36, 15-56 (1979) [61 ref. En] [Clinton Corn Processing Co., Clinton, Iowa 52732, USA]

After a brief discussion of the development of industries involved in production of sweeteners from starch, the processes and principles of manufacture of nutritive sweeteners are reviewed. Aspects covered include processes and products based on hydrolysis reactions, especially corn syrup and crystalline D-glucose technology, both acid-catalysed and enzyme-catalysed systems being covered; and processes and products based on isomerization reactions, including nonenzymic and enzymic systems, especially processes for production of high fructose corn syrup. DIH

## 53

Cellulases: biosynthesis and applications. [Review]  
Ryu, D. D. Y.; Mandels, M.

*Enzyme and Microbial Technology* 2 (2) 91-102 (1980) [212 ref. En] [Korea Advanced Inst. of Sci., PO Box 150, Chung-Ryang-Ro, Seoul, S. Korea]

Economics of hydrolysis of cellulose to produce glucose for food use or as chemical feedstock are reviewed, as is the current status of cellulase technology, in particular cellulases from *Trichoderma reesei*. Although economics of glucose production using *Trichoderma* cellulases are still unfavourable, improvements in sample pretreatments, reduction of cellobiose inhibition, and methods to increase enzyme efficiency and stability may change this position in the future. DIH



## 54

**Conversion of cellobiose to glucose using immobilized  $\beta$ -glucosidase reactors.**

Venardos, D.; Klei, H. E.; Sundstrom, D. W.  
*Enzyme and Microbial Technology* 2 (2) 112-116  
(1980) [37 ref. En] [Dep. of Chem. Eng., Univ. of Connecticut, Storrs, Connecticut 06268, USA]

Cellobiose is an intermediate in enzymic hydrolysis of cellulose to glucose and acts as an inhibitor for the cellulase enzymes. The conversion of cellobiose to glucose was studied with  $\beta$ -glucosidase adsorbed on Amberlite DP-1, a cation-exchange resin. The best overall pH for adsorption and reactor operation was near 5.0. The  $K_m$  values increased with increasing enzyme loading due to competitive inhibition. The max. practical enzyme loading was about 28 units/g resin. The immobilized enzyme was operated continuously in both packed bed and fluidized bed reactors, giving half-lives between 200 and 375 h. AS

## 55

**Soluble and immobilized enzyme technology in bioconversion of barley starch.**

Linko, Y.-Y.; Lindroos, A.; Linko, P.  
*Enzyme and Microbial Technology* 1 (4) 273-278  
(1979) [20 ref. En] [Dep. of Chem., Helsinki Univ. of Tech., Helsinki, SF-02150 Espoo 15, Finland]

Homogeneous and heterogeneous biocatalysis were both investigated as tools for barley starch syrup production. Barley starch was first liquefied by soluble heat-stable *Bacillus* sp.  $\alpha$ -amylase EC 3.2.1.1 (1,4- $\alpha$ -D-glucan glucanohydrolase) Termamyl 60 L at 95°C, pH 6.5, to obtain slurries of varying DE-values up to approx. 37. Alternatively, it was extruded with a Creusot-Loire BC 45 twin-screw extruder at 25% moisture, 150°C, for denaturation. After cooling and adjusting the pH to 4.5 or grinding, resp., pretreated starch was saccharified either by soluble or by immobilized *Aspergillus niger* glucoamylase EC 3.2.1.3 (1,4- $\alpha$ -D-glucan glucohydrolase) at 60°C, pH 4.5, to obtain glucose syrup of up to DE 96. The course of hydrolysis was followed by automated Biogel P-2 chromatographic analysis. Glucoamylase was immobilized either on a phenol-formaldehyde resin Duolite S 761 or on silanized Spherosil porous silica beads. Barley glucose syrup obtained was further continuously converted to high fructose syrup by a packed bed reactor of *Actinoplanes missouriensis* whole cell glucose isomerase (EC 5.3.1.5) Maxazyme entrapped within  $\alpha$ -cellulose beads. Barley starch may be used as an alternative raw material for biocatalytic starch syrup production. AS

## 56

**Purification of crude glucose solution from the enzymatic hydrolysis of potato waste, by solvent precipitation, ultrafiltration and ion exchange.**

Moreton, R. S.; Gibson, J.  
*Journal of Food Technology* 15 (2) 147-161 (1980)  
[12 ref. En] [Cent. for Applied Microbiol. & Res., Porton Down, Salisbury, Wilts. SP4 0JG, UK]

A crude, dilute glucose solution produced by enzymic hydrolysis of waste from a dehydrated potato plant, contained high concn. of noncarbohydrate and coloured

materials. Purification using solvent precipitation, ultrafiltration and ion exchange, reduced the concn. of noncarbohydrate materials from 27% to 3%, and increased the glucose concn. from 53% to 96% of the total dissolved solids. The purified material was suitable for use in some food applications or as a fermentation substrate. AS

## 57

**Equilibrium relationships in the degradation of starch by an amyloglucosidase.**

Beynum, G. M. A. van; Roels, J. A.; Tilburg, R. van  
*Biotechnology and Bioengineering* 22 (3) 643-649  
(1980) [2 ref. En] [Res. & Development, Gist Brocades NV, PO Box 1, 2600 MA Delft, Netherlands]

A study was carried out to ascertain how far equilibrium relationships influence the degradation of dextrans to glucose by amyloglucosidase. Various concn. of glucose and dextrans, with an intermediate degree of polymerization (DE of 15) were incubated for 6 days with soluble amyloglucosidase preparation, Amigase or Gist-Brocades at 45-65°C and total dry substances concn. of 10-40%. Final concn. of glucose, maltose and isomaltose were determined by HPLC and results are presented in graphs. The results are discussed in detail and comparisons made with theoretical results (with which the experimental results agree quantitatively). SP

## 58

**An investigation of the properties of glucoamylase immobilized on glass beads involving 5-diazosalicylic acid bonded to a titanium(IV) oxide film.**

Kennedy, J. F.; Chaplin, M. F.  
*Enzyme and Microbial Technology* 1 (3) 197-200  
(1979) [33 ref. En] [Dep. of Chem., Univ. of Birmingham, PO Box 363, Birmingham B15 2TT, UK]

Glucoamylase was immobilized as described in the title, and kinetic and thermodynamic properties of the free and immobilized enzyme were compared. Significant differences were noted from properties of the free enzyme, especially for the following (values for free enzyme in parentheses): activation energy 19.3 (57.4) kJ/mol;  $V_{max}$  starch 4.7 (22.6), and maltose 80 (1004) units/min mg;  $K_m$  starch 1.2 (0.13) % w/v, and maltose 1.8 (37.4) mM; and pH optimum 4.0 (4.5). Most efficient use of the immobilized enzyme would be production of glucose syrups from dilute maltose solutions. DIH

## 59

**Effects of corn syrups in layer cakes.**

Koepsel, K. M.; Hosney, R. C.  
*Cereal Chemistry* 57 (1) 49-53 (1980) [15 ref. En] [Dep. of Grain Sci. & Ind., Kansas State Univ., Manhattan, Kansas 66506, USA]

4 corn syrups and glucose were used to replace sucrose in high-ratio white layer cakes. At 100% replacement of sucrose, only the high maltose corn syrup gave a cake with acceptable vol. The amylograph was used to study the effect of corn syrups on starch pasting characteristics. Swelling temp. was related to the amount of sugars present. Low mol. wt. sugars in



syrups gave lower swelling temp. than did equal quantities of high mol. wt. sugars. Water activity and gelatinization temp. were apparently related. Corn starch lipids, extracted with methanol, were added to the sucrose-flour mixture in the amylograph. The resulting amylogram was similar in appearance (but not in swelling temp.) to that produced when corn syrups were used. High maltose corn syrup extracted with chloroform gave an amylogram similar to that with sucrose. However, cakes baked from the extracted syrup, although equal to sucrose cakes in appearance, vol. and grain, were sticky and definitely inferior in mouthfeel. AS

## 60

### Mutagenicity of the browning mixtures by amino-carbonyl reactions on *Salmonella typhimurium* TA 100.

Shinohara, K.; Wu, R. T.; Jahan, N.; Tanaka, M.; Morinaga, N.; Murakami, H.; Omura, H.  
*Agricultural and Biological Chemistry* 44 (3) 671-672 (1980) [6 ref. En] [Dep. of Food Sci. & Tech., Kyushu Univ., Fukuoka, Japan]

A mixture of 1M glucose + equimolar lysine was heated in aqueous solution at 100°C for 10 h. Quantities of the mixture were then tested for mutagenicity using *S. typhimurium* TA 100 (without S-9 mixtures), using  $1 \times 10^6$  cells/plate. Increasing amounts of the browning mixture up to 0.2 ml caused increasing numbers of revertants, up to 730/plate; higher doses were lethal to the bacteria. Glucose or lysine heated alone had no such mutagenic activity. Increase in browning intensity (at 470 nm) paralleled increase in mutagenicity during a time-course study of the reaction mixture. DIH

## 61

### The effect of water activity on reaction kinetics of food deterioration.

Labuza, T. P.

*Food Technology* 34 (4) 36-41, 59 (1980) [35 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Minnesota, St Paul, Minnesota 55108, USA]

The purpose of this paper is to explain how water activity ( $a_w$ ) controls the rate of chemical reactions in foods and also to illustrate the need for further elucidation of the kinetic mechanisms involved in such reactions. The following aspects are discussed: chemical reaction kinetics; effect of  $a_w$  on rate constant factors, concn. of reacting species, and reaction order; local phase effects; and effect of  $a_w$  on rate of lipid oxidation. The various effects of  $a_w$  on chemical reactions are illustrated by reference to several studies, both published and unpublished, e.g. vitamin C loss in infant cereal as a function of temp. and  $a_w$ , browning of skim milk powders at 3 moisture levels, browning rate vs.  $a_w$  and moisture content for a casein-glucose model system, and oxidation rate of potato chips as a function of  $a_w$ . JA

## 62

### Enhancement of mutagenicity of acetylaminofluorene by heating product of glucose in alkaline solution.

Okamoto, H.; Yoshida, D.

*Agricultural and Biological Chemistry* 44 (2) 439-441 (1980) [8 ref. En] [Cent. Res. Inst., Japan Tobacco & Salt Public Corp., 6-2 Umegaoka, Midori-ku, Yokohama, Kanagawa 227, Japan]

Glucose (10 g) was heated in 1N NaOH (70 ml) in an autoclave at 120°C for 1-8 h, and the effects of an ethyl acetate extract of the autoclaved mixture on the mutagenicity of acetylaminofluorene (AAF), and other mutagens, were studied. AAF mutagenicity as measured by the Ames test using *Salmonella typhimurium* TA98 + liver microsomal mix, was increased 4.7-6.8 × by addition of 200 µg of the extract. The extract itself was not mutagenic. No effect on AAF mutagenicity was observed when extracts of acid-treated glucose (0.1N acetic acid instead of 1N NaOH) were added to the Ames assay. The ethyl acetate fraction of the alkaline incubation was fractionated; most of the AAF mutagenicity enhancing activity was in the neutral fraction. More detailed fractionation using a silica gel column showed that a fraction eluted with benzene/ethyl acetate (5:5) had the highest mutagenicity-increasing activity with AAF. Effect of this fraction on mutagenicity of other mutagens was studied; those of 2-aminofluorene, 2-aminoanthracene, 3-amino-1-methyl-5H-pyrido[4,3-b]-indole and benzo(a)pyrene were increased. Consequences for food manufacturing and cooking processes are briefly discussed. DIH

## 63

### Sugars and nonvolatile acids of blackberries.

Wrolstad, R. E.; Culbertson, J. D.; Nagaki, D. A.; Madero, C. F.

*Journal of Agricultural and Food Chemistry* 28 (3) 553-558 (1980) [7 ref. En] [Dep. of Food Sci. & Tech., Oregon State Univ., Corvallis, Oregon 97331, USA]

The sugars and nonvolatile acid composition of blackberries were investigated with the purpose of acquiring base-line data which can be used to establish authenticity of blackberry products. Sugars and acids were isolated using ion-exchange techniques, and their trimethylsilyl derivatives were separated by GLC. Fifteen samples were analysed, with sample selection giving consideration to varietal, maturity, and processing effects. Glucose and fructose were the only sugars detected, the glucose/fructose ratio for all samples being 0.710. The acids (phosphoric, malic, lactoisocitric, citric-isocitric, and quinic) showed considerable variation, lactoisocitric being absent in 6 of the samples. Maturity had considerable effect on the composition, while processing into a concentrate induced little change. AS

## 64

### Separation and quantitative determination of fructose as the O-methyloxime by gas-liquid chromatography using glass capillary columns.

Zegota, H.

*Journal of Chromatography* 192 (2) 446-451 (1980) [14 ref. En] [Inst. of Applied Radiation Chem., Tech. Univ. of Lodz, Wroblewskiego 15, 93-590 Lodz, Poland]

Separation of mono- and oligosaccharides by gas chromatography is difficult due to formation of multiple



peaks of tautomeric forms of reducing sugars. Earlier work showed that the number of tautomers can be reduced by converting the sugars to oximes before forming the trimethylsilyl ethers (TMS), but difficulty remained in separating peaks of fructose and some isomers of glucose and galactose. In the present improved method, fructose or other monosaccharides were converted to *O*-methyloximes (MO) with methoxylammonium chloride and thence to TMS derivatives (details of methods given). For the gas chromatography, high efficiency glass capillary columns coated with OV-101 or SE-30 containing Silanox 101 were used. Peak areas were measured and glucitol was used as internal standard. Chromatograms are given of MO-TMS derivatives. With fructose alone, recoveries of added amounts were 94–107% with clear separation of peaks of the syn and anti forms. With mixtures of fructose and other monosaccharides, 2-deoxyribose, arabinose and 2-deoxyglucose gave single peaks, while rhamnose, galactose, glucose and fructose each gave clear double peaks. Column retention data are tabulated. ELC

## 65

[Viscosity of glucose solutions and syrups.]

Gulyuk, N. G.; Pikhalo, D. M.

*Sakharnaya Promyshlennost'* No. 3, 52–54 (1980)

[6 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

Measurements of the viscosity of glucose solutions and syrups formed by acid hydrolysis of starch and by fermentation are presented. Deviations from the commonly used empirical relations were found.

Viscosity calculations can be made for solutions of various compositions. STI

## 66

An energy analysis of the manufacture of wheat starch and related products.

Crafts-Lighty, A. L.; Beech, G. A.; Ealden, T. N.

*Journal of the Science of Food and Agriculture* 31 (3)

299–307 (1980) [17 ref. En] [RHM Res. Ltd., High

Wycombe, Bucks HP12 3QR, UK]

A study was made of energy use in manufacture of wheat starch and related products. The process examined, the Tenstar method, used wheat flour as raw material for producing the following products: wheat starch in dry or wet form, dried wheat gluten, glucose syrup and produced dextrose. Energy use in the associated flour milling process was also examined. Milling and transport of wheat and flour accounted for 1.27–1.31 GJ/t dry solids (DS) of each Tenstar product, whereas manufacture required 4.81–31.33 GJ/t product DS. Wet starch was the least energy intensive product and dried gluten the most energy intensive on this basis. However, energy inputs to gluten, when related to this product's protein content, showed wheat gluten to be a dietary protein source whose production has a very low energy requirement (57.8 GJ/t protein). Energy requirements for manufacturing powdered dextrose are similar to reported requirements for refining sucrose from sugar beets, giving an energy ratio (gross calorific energy output: energy input) of 0.53 for dextrose, as compared to 0.49–0.71 for beet sugar. AS

## 67

Stability of the plasma membrane in *Saccharomyces rouxii* and its relationship to glucose tolerance.

Moran, J. W.; Witter, L. D.

*Applied and Environmental Microbiology* 39 (4) 928–931 (1980) [19 ref. En] [Dep. of Food Sc., Univ. of Illinois, Urbana, Illinois 61801, USA]

Many foods are preserved by drying or by the presence of large amounts of solutes, and in such foods osmotrophic yeasts can be important spoilage agents. The osmotrophic yeast *S. rouxii* is a unique microorganism in that it is tolerant to high concn. of both sugars and NaCl. The stability of spheroplasts from *S. rouxii* was studied in buffered solutions of mannitol and glucose. Plasma membranes from cells grown in high glucose concn. were more stable to osmotic lysis than those grown in lower glucose concn. Mannitol was a better osmotic stabilizer than glucose, except in high glucose concn. Results suggest the involvement of the plasma membrane in the glucose-tolerant mechanism of *S. rouxii*. AL

## 68

High performance liquid chromatographic determination of carbohydrates in chocolate: collaborative study.

Hurst, W. J.; Martin, R. A., Jr.

*Journal of the Association of Official Analytical Chemists* 63 (3) 595–599 (1980) [7 ref. En] [Res. Lab., Hershey Foods Corp., PO Box 54, Hershey, Pennsylvania 17033, USA]

A collaborative study determining sucrose, glucose, fructose, maltose and lactose in chocolate products was conducted using a previously published HPLC method [FSTA (1978) 10 3K12]. 5 samples (2 milk chocolates, 1 dark chocolate, 1 powdered mix, and 1 syrup) were analysed in duplicate by 7 collaborators. The results indicate adequate method precision. In addition, the HPLC method allows for the simultaneous detn. of 5 saccharides in chocolate products in 15 min. The method has been adopted as official first action. AS

## 69

[Rational bleaching of glucose syrup juices.]

Gulyuk, N. G.; Dubinskaya, I. P.; Sidorova, E. K.

*Sakharnaya Promyshlennost'* No. 12, 35–37 (1979)

[Ru] [NPO po Krakhmaloproduktam, USSR]

Thin and thick glucose juice is bleached in all Soviet factories manufacturing glucose syrup. Several methods of bleaching were tested, including activated carbon, bleaching of thin and thick juice, thin juice only and thick juice only. The best technique is to bleach thin juice, in which the syrup has max. clarity and is lowest in colour. STI

## 70

[Experimental studies on bacterial degradation of sugar in raw juice and in preliming juice.]

Hollans, F.; Wieninger, L.

*Sucrerie Belge* 99 (5) 183–193 (1980) [19 ref. Fr. en, de, nl] [Inst. du Recherche du Sucre, Fuchsenbigl, Austria]

Investigations of the bacterial conversions in raw



juice and preliming juice agar (slide culture) showed a largely pure lactic acid fermentation under anaerobic conditions. Under aerobic conditions only small lactic acid yields were obtained from conversion of sugar: greatly increased glucose and fructose contents were obtained in raw juice cultures at 45° and 50°C, also in preliming juice (pH 8.9) at 55°C. Studies of bacterial strains isolated from the preliming juice after incubation showed that the increase in monosaccharides was due to sucrose hydrolysis by *Bacillus licheniformis*, with simultaneous formation of laevan. Under strictly anaerobic conditions (preliming juice, 55°C) sucrose hydrolysis proceeded faster than decomposition of the liberated hexoses when nitrate was added to the culture. Even with this 'nitrate respiration' only a portion of the sugar consumed was converted to lactic acid. Aerobic sucrose hydrolysis can also be due to highly thermophilic bacterial strains. This was shown by an investigation into bacterial conversions in the juice region of the extraction plant (BMA tower) and raw juice passages: an increase in glucose and fructose contents (caused by bacteria) was observed in the juice in the upper part of the tower and especially in press water (69°C). AS

## 71

**[Glucose-fructose separation.]**

Toray Industries Co. Ltd.

*Japanese Examined Patent* 5 515 200 (1980) [Ja]

A process is described for separating fructose and glucose from aqueous mixtures employing a specified zeolite as an adsorbing agent. IFT

## 72

**Immobilized enzyme technology commercially hydrolyzes lactose.**

Moore, K.

*Food Product Development* 14 (1) 50-51 (1980) [En]

Lactose can be enzymically converted into high quality glucose-galactose sweetener syrups exhibiting increased solubility, sweetness and crystallization stability compared to lactose. Syrup production occurs in 5 steps as whey, whey permeate or milk permeate move through the 3-component system.

A deproteinized, demineralized substrate (solids level <20% and pH <3.5) is added to a feed tank. Tank temp. is controlled at 35-50°C and pH adjusted to maintain a constant hydrolysis rate and throughput. The product is pumped into the top of an immobilized enzyme column. As it passes down the column, lactose is hydrolysed and glucose, galactose and residual lactose withdrawn at the bottom. No other products are formed. Following hydrolysis, glucose and galactose normally are concentrated to a 60%-plus solids syrup and the column cleaned by daily backflushing with dil. acetic acid. Each unit operates continuously, processing 360-500 l. of lactose/h with an 80% average hydrolysis rate. Approx. 30 000 l of whey yield 1.7 t of hydrolysed syrup. Advantages of hydrolysed lactose sweeteners are considered. VJG

## 73

**High performance liquid chromatographic determination of fructose, glucose, and sucrose in molasses.**

Damon, C. E.; Pettitt, B. C., Jr.

*Journal of the Association of Official Analytical Chemists* 63 (3) 476-480 (1980) [10 ref. En] [Tech. Service Div., US Customs Service, Washington, DC 20229, USA]

Fructose, glucose, and sucrose were determined quantitatively in molasses by HPLC using maltose as an internal standard. After a simple cleanup procedure, chromatographic separation required <20 min for the 17 molasses samples. HPLC gave lower results for reducing sugars (fructose plus glucose) and for sucrose by an average of 3.9 and 1.2%, resp., when compared to results obtained by classical methods. The lower values are believed to result from elimination of interfering substances by this method. The values probably reflect more accurately the true composition of the molasses. Repetitive injections of a standard solution indicated a coeff. of variation of 2.0% for fructose and glucose and of 2.2% for sucrose. AS

## 74

**High pressure liquid chromatography for the analysis of sugar cane saccharides.**

Wong-Chong, J.; Martin, F. A.

*Sugar y Azucar* 75 (6) 40, 44, 48, 50-51, 54-55, 58 (1980) [13 ref. En] [Louisiana Agric. Exp. Sta., Louisiana State Univ., Baton Rouge, Louisiana 70803, USA]

Studies on separation of sugars, salts and sugar juice deterioration products by HPLC are described. Trials were conducted with a  $\mu$ Bondapak/carbohydrate resin column (with acetonitrile/water 80:20 as eluent), and ion exchange resin columns (Aminex Q150S or Aminex/carbohydrate HPX87, elution with water). Chromatograms are presented. The  $\mu$ Bondapak/carbohydrate column generally gave good separation of sucrose, glucose and fructose, but was unsuitable for routine use because of the long elution time of higher polysaccharides present in some juice samples. Aminex Q150S gave good and rapid separation of sucrose, glucose and fructose; deterioration products could also be separated. Lactic acid in deteriorated samples interfered with detn. of sucrose and glucose on Aminex/carbohydrate HPX87. Correlations between sugar concn. determined by HPLC and by polarimetry ranged from 0.989 for fresh juices to 0.460 for badly deteriorated juices; HPLC is appreciably superior to polarimetric techniques for low-quality juices containing optically-active deterioration products. AJDW





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FAB 20

USE OF GLUCOSE IN FOOD PRODUCTS

SELECTED FROM VOLUME **13**

FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

under the direction of:-

Commonwealth Agricultural Bureaux, Farnham Royal, Slough; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublikaties en Landbouwdocumentatie (Pudoc), Wageningen.

11



## INTRODUCTION

Food Annotated Bibliographies (FABs) are collections of abstracts on specific topics in food science and technology. The topics are chosen by the staff of the International Food Information Service as being of particular interest or importance. The topics normally interest individual workers, who may not require the full information provided in Food Science and Technology Abstracts, from which the abstracts for FABs are taken. The size and the cost of the FABs are controlled as much as possible with the interests of individual workers in mind.

Titles of the FABs now available are given on the back cover of this booklet. For up-to-date lists of FABs or suggestions for new topics please write to the address on the back cover. New subjects are searched for at least the five most recent volumes of Food Science and Technology Abstracts. Thereafter each FAB is updated monthly. Copies of each month's abstracts on any topic may be obtained as indicated on the back cover of this publication. At the end of each volume of up-dating, the abstracts are merged and made available as a separate supplement to the original FAB.

Some of the larger FABs have been divided into sections to facilitate use. FAB 47 also has a subject and author index provided.

Copies of all original articles referred to in the abstracts may be bought (or occasionally borrowed) from the International Food Information Service. A form for ordering these is provided at the end of this FAB.

Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

EDITOR





1

[Effect of sugar addition on quality of freeze-dried strawberry puree.]

Lovric, T.; Pilizota, V.; Abramovic, G.

*Prehrambeno Tehnoloska Revija* 16 (3) 76-80 (1978) [5 ref. Sh, en] [Tehnoloski Fak, Zagreb, Yugoslavia]

Sieved strawberry pulp was freeze-dried alone or with addition of sucrose or glucose, to give total DM contents of 18 or 25%, in a BIIIC (Italy) installation. The dried samples were sealed under N<sub>2</sub> until analysis, which covered contents of moisture, anthocyanins, ascorbic acid, and aroma compounds (by GLC), and organoleptic quality (colour, taste and aroma). It is concluded from results (tabulated in detail) that best preservation of anthocyanin pigments, colour and organoleptic quality was obtained by freeze-drying the puree with sucrose added to 18% total DM. SKK

2

A study of immobilized enzyme reactor.

Chen, Y. E.

*Dissertation Abstracts International*, B 40 (9) 4393:

Order no. 80-05844, 147 pp. (1980) [En] [Purdue Univ., West Lafayette, Indiana 47907, USA]

Studies were made of a commercially feasible process for producing high-glucose sugar from partially hydrolysed starch. The process utilizes glucoamylase immobilized on PVC-silica membranes. Such membranes have 70% porosity and most of the pores are open channels which means that the immobilized enzyme molecules do not experience pore diffusion limitations. Experimental studies indicated that the immobilized enzyme produces 93-97% conversion of starch to glucose. Extensive studies were made of enzyme immobilization and of reactor performance and design, the aim being to optimize glucose yield while keeping other reaction variables within commercially acceptable limits. The information obtained in these studies and data collected from a total-recycled batch reactor were used to design a continuous flow single-pass column reactor. Theoretical modelling was used to estimate the number of membranes needed for a single-pass reactor. JA

3

[Method for studying the kinetics of sugar crystallization.]

Gulyuk, N. G.

*Sakharnaya Promyshlennost'* No. 11, 45-47 (1979)

[3 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

Crystallization was assessed by viscometry: viscosity of the solution in constant conditions of mixing and temp. was continuously monitored with the 'Reotest'. When nuclei are being formed in highly supersaturated solutions and during spontaneous crystallization of glucose crystals which are formed as thin needles with rectangular cross section, these change the rheology of the suspension. Experiments were carried out with a 75% solution of glucose containing 0.5% of crystals. The method can be applied to investigate the degree of crystallization of e.g. sucrose, glucose, maltose, and the action of various factors on this process. STI

4

[High pressure liquid chromatography for the analysis of sugar cane saccharides.]

Wong-Chong, J.; Martin, F. A.

*Sugar y Azucar* 75 (7) 64-65, 68, 74-78 (1980) [13 ref. Es] [Agric. Exp. Sta., Louisiana State Univ., Baton Rouge, Louisiana, USA]

See FSTA (1980) 12 12L862 for original En version of this paper.

5

[Studies on spray-drying of invert sugar.] Versuche zur Sprühtrocknung von Invertzucker.

Bergnofer, E.; Klaushofer, H.; Kronberger, A.

*Zeitschrift für Lebensmittel-Technologie und -Verfahrenstechnik* 31 (4) 157-162 (1980) [44 ref. De] [Inst. für Lebensmitteltech., Univ. für Bodenkultur, A-1190 Vienna, Austria]

Characteristics of invert sugar, sucrose, glucose and fructose of importance for spray-drying of these sugars are discussed, together with literature data on spray-drying of syrups of these sugars. Laboratory experiments on spray-drying of glucose, a glucose/maltodextrin blend, fructose, or a fructose/glucose blend are described; details are given of the equipment and processing conditions used. Tables of data are given for yield, and the DM and moisture contents and colour of the dried product. The results show that good results could not be achieved by spray-drying of the syrup alone; recirculation of dry product was necessary. Optimum dry product/syrup ratios were 3:1 for glucose, 2.7:1 for fructose and 4.6:1 for a glucose/fructose blend. Spray-drying of the glucose/fructose blend presented greater problems than spray-drying of either glucose or fructose alone. AJDW

6

Porosity of a unique corn sugar has vast food application potential.

Andres, C.

*Food Processing* 41 (5) 58-59 (1980) [En]

A dry corn sugar, consisting of 92% glucose, has a unique physical structure which enables it to absorb up to 25% fat without restricting free flow properties. The sugar is in the form of spherical granules which have a large internal void volume and have numerous pores connecting to the outside of the granule. The material can be used not only to adsorb concentrates and flavours, but also shows excellent behaviour under direct compression for candy production, and dissolves approx. 13% faster in water than does commercial dextrose. JRR



Metabolic activities of *Lactobacillus brevis*. Effect of pH, glucose and butane-2,3-diol.

Hieke, E.; Vollbrecht, D.

*Zeitschrift für Lebensmittel-Untersuchung und -Forschung* 171 (1) 38-40 (1980) [10 ref. En, de] [Max von Pettenkofer-Inst. des Bundesgesundheitsamtes, Bundesgesundheitsamt, Postfach D-1000 Berlin 33]

The effect of pH on the metabolic activities of *Lactobacillus brevis* was studied. Significant changes in the patterns of volatile components were found on increasing the pH of yeast wine from 3 to 6. Butan-2-ol was formed at pH 6; after fermentation the concn. of propan-1-ol was increased by 38.5% at pH 6.62% at pH 4.5, and 30% at pH 3.0. The effect of glucose and butane-2,3-diol on the production of volatile components was examined in a synthetic medium at pH 6.0. It was shown that propan-1-ol was formed exclusively from glucose, whereas ethyl acetate, butan-2-ol and other unknown substances were formed from butane-2,3-diol. The course of ethyl acetate formation from butane-2,3-diol is discussed. AS

## 8

[The use of isoglucose in the beverage industry.] Die Verwendung von Isoglucose in der Getränkeindustrie. Günzel, H.

*Monatsschrift für Brauerei* 33 (7) 247-258 (1980) [De, en, fr] [Aspera Farbeibierbrauerei Riese & Co., Postfach 01 01 25, D-4330 Mülheim/Ruhr, Federal Republic of Germany]

This discussion of isoglucose (high-fructose corn syrup) and its use in the beverage industry includes the following aspects: manufacture from wheat or corn; continuous manufacture; quality control; composition; relative sweetness; taste; colour; bacteriological quality; handling and storage; viscosity; osmotic characteristics; solubility; mixed isoglucose/sucrose syrups; use of isoglucose in soft drinks; use in beers; use in liqueur manufacture; and legal aspects of use of isoglucose in beverages in the Federal Republic of Germany. AJDW

## 9

Saccharification of glucose raffinate or mother liquid.

Poulsen, P. B. R.; Rugb, S.; Norman, B. E. (Novo Industri AS)

*United States Patent* 4 206 284 (1980) [En]

Glucose syrup is saccharified with amyloglucosidase at saccharifying temp. and pH conditions. IFT

## 10

Taste perception and flavor acceptance of cakes prepared with monosaccharides.

Thompson, C. M.; Mickelsen, O.; Schemmel, R.; Funk, K.; Kakade, M. L.

*Nutrition Reports International* 21 (6) 913-922 (1980) [33 ref. En] [Dep. of Food Sci. & Human Nutr.; Michigan State Univ., East Lansing, Michigan 48824, USA]

Acceptability of cakes, prepared with glucose, fructose or mixtures thereof in place of sucrose, was evaluated as a means of securing a product which minimized the health disadvantages attributed to sucrose. An 11 member taste panel reported that the

flavour of butter-type cakes was acceptable when sucrose was replaced by an equal wt. of a high fructose containing corn syrup (HFCS), a mixture of equal parts of glucose and fructose (fructose/glucose) or fructose. The butter-type cake was chosen since it contains 37% sucrose on the dry wt. basis. The panelists reported the interior of the cakes to be acceptable, in decreasing order, when they were made with sucrose, HFCS, fructose, fructose/glucose or glucose. The crust flavour of cakes prepared with sucrose was highly acceptable followed by the crust from cakes made with fructose, fructose/glucose and HFCS in that order; the crust of the cakes made with glucose received a much lower rating. For the latter, the tart, lingering aftertaste of the crust made the cake unacceptable to most panelists when it was eaten in the usual manner. The amount of lysine in the cake protein which became unavailable during the baking process was not related to the unpleasant taste which developed in the cakes made with some of the sugars. AS

## 11

Microtitration of ascorbic acid with copper.

Shahine, S.

*Mikrochimica Acta* I (1/2) 123-127 (1980) [4 ref. En, de] [Ain Shams Univ., Abassia, Cairo, Egypt]

A new titrimetric method for microdetermination of ascorbic acid was developed. It is based on oxidation to dehydroascorbic acid with  $\text{Cu}^{2+}$  in the presence of  $\text{NH}_4\text{SCN}$  using KI/starch indicator. The method is particularly suitable for dilute solutions ( $< 0.05\text{N}$ ) and can be used over the pH range 1-7. Glucose, fructose, aspirin, caffeine, rutin and calcium gluconate do not interfere; nor do citrate, oxalate and tartrate if the titration is done at pH 1-2. Bisulphite (e.g. in orange juice) can be masked with acetone, but novalgin must be absent. The method is simple, sensitive (0.003N-0.05N ascorbic acid) and accurate (mean error  $< 1\%$ ). AS

## 12

Conversion of cellulose to glucose with cellulase of *Trichoderma viride* ITCC-1433.

Herr, D.

*Biotechnology and Bioengineering* 22 (8) 1601-1612 (1980) [23 ref. En] [Lehrstuhl für Biotech., Tech. Univ. Berlin, D-1000 Berlin 65]

Utilization of cellulose depends on its conversion to glucose which can be used as a substrate for single cell protein or alcohol production. A cellulase complex rich in  $\beta$ -glucosidase, secreted by *T. viride* ITCC-1433 was studied with regard to optimal reaction and stability conditions. Hydrolysis at 50°C and pH 4.5 using a crude *T. viride* filtrate produced a nearly pure 4% glucose solution from a 10% cellulose suspension, whilst wood pulp and newsprint were hydrolysed to a smaller extent. An enzyme concentrate produced up to 8% glucose in 48 h with a glucose:cellobiose ratio of 75:1. Glucose was the most potent hydrolysis inhibitor, causing cellobiose and oligosaccharides to accumulate in an enzyme-substrate solution. On glucose removal from such a solution approx. 90% conversion to glucose was achieved in 48 h with no cellobiose accumulation. LH



### The use of immobilized enzymes in the food industry: a review. [Review]

Kilara, A.; Shahani, K. M.

*CRC Critical Reviews in Food Science and Nutrition* 12 (2) 161-198 (1979) [162 ref. En] [Dep. of Food Sci. & Tech., Univ. of Nebraska, Lincoln, Nebraska, USA].

The production of high fructose corn syrups was greatly facilitated by the use of immobilized glucose isomerase. Similarly, in Japan, the fermentation industry proved its processing efficiency for amino acids through the use of immobilized amino acid acylase. This article discusses the use of soluble enzymes in the food industry followed by a section on the various available methods to immobilize enzymes. Once enzymes are immobilized, many of their operational parameters could be altered. Rationale for the determination of the effects of immobilization is provided. A relatively new concept is the use of a single matrix for immobilizing more than one enzyme. Immobilized multi-enzyme systems offer many attractive advantages; however, such a process also raises some interesting questions about kinetics. These questions and their suggested answers are discussed in the penultimate section. The major emphasis of this article is on the use of immobilized enzymes in the food industry. Two systems - amino acylase and glucose isomerase - have been demonstrated to be techno-economically feasible. Immobilization of other enzymes, such as glucoamylase, lactase, protease, and flavour modifying enzymes, has received some attention. The potentials of these new systems are also discussed. AS

### 14

[Determination of the glucose content of honey and honey-containing products by enzyme analysis.] Polacsekne Racz, M.; Pauli, P.; Horvath, G.; Vamosne Vigyazo, L.

*Edesipar* 31 (1) 5-9 (1980) [9 ref. Hu, de, ru] [Központi Elemiszeripari Kutató Intézet, Budapest, Hungary]

By using the glucose oxidase/periodate method (Boehringer, Mannheim, Germany) for the determination of glucose in suitably diluted extractions of honey and honey-containing confectionery products, it was found that the glucose content of honey used for the production of commercially available products was 29-31%. The amounts of honey in the final products were calculated from the known glucose content of the honey. In honey-containing cakes during production the amount of honey did not change significantly, except during the baking process, when the losses may amount to 10-15%. It was also found that 85-90% of the glucose content of the starting dough mass originated from the honey, 2-3% from the flour, and 8-12% from the syrup used. In the measurements of glucose content the deviations were  $\pm 2.7\%$  in honey,  $\pm 4.3\%$  in cake powders, and  $\pm 7.8\%$  in unbaked dough. ESK

### Effect of replacing sucrose by different proportions of liquid and powder glucose in the corn syrup on the quality of canned mango slices.

Riaz-ur-Rahman; Ramzan, M.; Riaz, R. A.

*Pakistan Journal of Scientific and Industrial Research* 22 (1/2) 101-103 (1979) [12 ref. En] [Dep. of Food Tech., Univ. of Agric., Faisalabad, Pakistan]

'Langra' mango slices were canned in 30° Brix syrup containing 100% sucrose, or maize 'gur' white (glucose powder) or liquid glucose replacing 25, 50, 75 or 100% of the sucrose. Effect of replacing sucrose on canned product quality was studied during 180 days' storage at room temp. Throughout storage all samples showed a slight rise in drained wt. of canned slices, appreciable increase in total soluble solids and Brix/acid ratio, and considerable loss of ascorbic acid (from 80 mg/100 g in fresh slices, to 40-47 mg after canning and 16-28 mg after 180 days' storage). Tabulated results of organoleptic evaluation show that replacing sucrose by 25% glucose powder or liquid glucose had beneficial effects on colour, flavour, texture and taste of the stored product. [From En summ.] RM

### 16

[Dried glucose syrup.]

Taiwan, National Bureau of Standards

*Chinese National Standard* CNS 5083, 1p. (1979) [Ch]

### 17

[Glucose syrup.]

Taiwan, National Bureau of Standards

*Chinese National Standard* CNS 5084, 1p. (1979) [Ch]

### 18

Enzyme reactor design, kinetics and performance. (In 'Food process engineering 1979' [see FSTA (1981) 13 4E167].) [Lecture]

Venkatsubramanian, K.

Abstr. no. 4.0.4 (1979) [En] [H. J. Heinz Co., World Headquarters, PO Box 57, Pittsburgh, Pennsylvania 15230, USA]

Commercial conversion of dextrose to fructose using an immobilized enzyme (glucose isomerase) is used to illustrate engineering aspects of industrial reactor design and operation e.g. choice of reactor type, catalytic loading capacity, carrier form, inter- and intraparticle mass transport, reaction kinetics and residence time distribution. Specific considerations for particular products include reactor feed and effluent specifications, hydraulic, mechanical, flow pattern and pressure drop factors. On-line computer control can be a final objective. ELC

### 19

The production and properties of glucose syrups.

I. Production of glucose syrups by enzymatic hydrolysis of starch.

Kearsley, M. W.; Satti, S. H.; Tregaskis, I.

*Stärke* 32 (5) 169-174 (1980) [20 ref. En, de] [Nat. Coll. of Food Tech., St. George's Ave., Weybridge, UK]



The effect of selected metal ions, at different concn., on enzymic hydrolysis of maize starch, and the production of hydrogenated glucose syrup from maize starch by simultaneous enzymic hydrolysis and catalytic hydrogenation were investigated. Tabulated results showed that amyloglucosidase was not affected by metal ions (Ca 10–200 p.p.m.; Zn 4–50 p.p.m.;  $\text{Fe}^{3+}$  2–30 p.p.m.; Pb 2–20 p.p.m.; Ca/Zn/Fe/Pb, 200 + 15 + 5 + 5 p.p.m.); fungal and bacterial  $\alpha$ -amylase and  $\beta$ -amylase were affected to varying degrees. Ca ions had a positive effect on fungal and bacterial  $\alpha$ -amylases but no effect on  $\beta$ -amylase, while Zn, Fe and Pb ions had negative or nil effects. Simultaneous enzymic hydrolysis with  $\alpha$ - and  $\beta$ -amylase and catalytic hydrogenation showed enzyme inhibition by the Ni catalyst. High  $\text{H}_2$  pressure (100 atm) had little effect on the enzymes. Hydrolysis and hydrogenation of the starch fraction of milled whole defatted maize was also shown to be feasible. The results emphasize the need for careful choice of materials for reaction vessels and control of processing water, to ensure absence of inhibiting metal ions from the enzymic reaction. RM

## 20

**Studies on colouring matter produced by contact between quaternary ammonium ion-exchange resin and glucose. I. Its sorption on and desorption from the resin.**

Fujii, S.; Shibutani, I.; Komoto, M.

*International Sugar Journal* 82 (979) 199–203 (1980) [14 ref. En, fr, de, es][Fac. of Agric., Kobe Univ., Kobe, Japan]

When strongly basic anion-exchange resin was exhaustively reacted with glucose, a significant amount of colouring matter and organic acids was produced, and accumulated on the resin. The ion-exchange capacity of the resin was consumed by these substances, and the resin was fouled by the colouring matter which was difficult to desorb. Desorption of the colouring matter by various salts was examined. The order of desorbing strengths of the anions agreed with the reverse of their lyotropic series and the orders of relative selectivities and shrinking strengths. The perchlorate ion showed the greatest desorbing strength of the anions tested, viz. 3.25 times that of chloride and 81.25 times that of hydroxide. The relative desorbing strength of anions is proportional to the logarithm of the relative selectivities. The order of desorbing strengths was in agreement with the lyotropic series. The strengths of divalent cations were about double those of monovalent cations. Of the related colouring matters tested, that produced in the glucose-resin system has the greatest affinity for IRA-900 resin. In the uptake of colouring matter by the resin there was evidence of both ionic and molecular sorption. Concerning the sorption of colouring matter it was considered that a single molecule of the colouring matter may be sorbed on both the hydrophilic ion-exchange group and the hydrophobic matrix of the resin. AS

## 21

**Studies on the combined action of amylases and glucose isomerase on starch and its hydrolyzate. I. Production, extraction, purification and kinetic behavior of glucose isomerase.**

Attia, R. M.; Ghali, Y.; Roushdi, M.; Alaa Eldin, M. *Zeitschrift für Ernährungswissenschaft* 19 (2) 71–87 (1980) [19 ref. En][Enzyme Unit, Agric. Res. Cent., Giza, Egypt]

Glucose isomerase from *Streptomyces phaeochromogenes* was purified by  $(\text{NH}_4)_2\text{SO}_4$  precipitation, chromatography on Amberlite CG-50 and acetone precipitation. Optimum pH and temp. were 7.0 and 70°C, resp.;  $K_m$  for D-glucose was 0.25M and for  $\text{Mg}^{2+}$  was 0.024M. Optimum glucose and  $\text{Mg}^{2+}$  concn. were, 0.8M and 0.07M, resp. DIH

## 22

**Barley starch conversion by immobilized glucoamylase and glucose isomerase. (In 'Food process engineering 1979'[see FSTA (1981) 13 4E167]) [Lecture]**

Lindroos, A.; Linko, Y.-Y.; Linko, P.

Abstr. no. 4.1.15 (1979) [1 ref. En][Dep. of Chem., Helsinki Univ. of Tech., SF-02150 Espoo 15, Finland]

Barley starch has become available as an alternative to corn, potato or wheat starch for producing glucose, high fructose, maltose and maltodextrin syrups by starch degradation with  $\alpha$ - and glucoamylases and conversion to fructose by immobilized glucose isomerase. Commercial barley and wheat starches were compared as substrates for continuous processing of  $\alpha$ -amylase liquefied starch with an immobilized glucoamylase (from *Aspergillus niger*) on silanized porous silica beads or phenolformaldehyde resin. Only minor differences were observed in conversion rate and final DE values for the 2 starches. With standard soluble glucoamylase hydrolysis of DE 28 liquefied starch slurry at 60°C and pH 4.5 produced a final DE of 96–97; max. conversion rate obtained with immobilized glucoamylase was DE 95. A 2 enzyme packed bed reactor of immobilized glucoamylase and glucose isomerase could produce glucose-fructose syrups of varying DE values. ELC

## 23

**Immobilized glucoamylase. (In 'Food process engineering 1979'[see FSTA (1981) 13 4E167]) [Lecture]**

Poulsen, P. B.; Amotz, S.; Rugh, S.

Abstr. no. 4.1.16 (1979) [3 ref. En][Novo Res. Inst., Bagsvaerd, Denmark]

Soluble glucoamylase preparations have been used industrially for some time, but application of the immobilized form has been limited, probably because saccharification of dextrans has not achieved the 93–95% conversion to glucose required. A new NOVO immobilized glucoamylase suitable for production of high conversion syrups and saccharification of raffinose is described. ELC



## 24

**Isomerized syrups of increased fructose content.** (In *'Food process engineering 1979'* [see FSTA (1981) 13 4E167]) [Lecture]

Karonen, R.; Poutanen, K.; Linko, Y.-Y.; Linko, P. Abstr. no. 4.1.19 (1979) [5 ref. En] [Dep. of Chem., Helsinki Univ. of Tech., SF-02150 Espoo 15, Finland]

Existing processes for producing glucose/fructose syrups from starch achieve a max. of 42-45% fructose in the total sugars when using immobilized glucose isomerase, but for some food purposes (e.g. beverages) sweeter syrups with less tendency to crystallize are desired. Direct conversions reaching 90% w/w fructose are obtainable by adding borate ions to a reaction mixture, but anion exchange resins in partial borate form proved unsatisfactory for immobilized glucose isomerase. A strong anion exchange resin in bisulphate form proved successful for fractionation of isomerized hydrolysates of starch or whey lactose syrups. By adjusting the elution rate, fructose, glucose and galactose could be completely or partially separated from one another to produce a range of syrups, and glucose containing some fructose could be recycled to isomerization. ELC

## 25

**Enzymatic conversion of wheat starch and grain.** (In *'Food process engineering 1979'* [see FSTA (1981) 13 4E167]) [Lecture]

Remiszewski, M.; Linko, Y. Y.; Leisola, M.; Linko, P. Abstr. no. 4.2.15 (1979) [2 ref. En] [Starch & Potato Products Res. Lab., Poznan, Poland]

Enzymic conversion of wheat starch to glucose and direct enzymic hydrolysis of wheat grain were studied, using various methods of starch liquefaction and further saccharification with different enzymes to maltose, and high DE glucose syrups. Wheat starch hydrolysates were much more difficult to filter than corn or potato starch products, but clarification was improved by heat treatment to 140°C after liquefaction; liquefaction at 95°C with Novo 'Termamyl'  $\alpha$ -amylase yielded a product with better filtering characteristics than those from lower temp. enzymes. Direct enzyme hydrolysis was carried out with ground whole wheat grain and produced easily filtered hydrolysates. Sugar composition of hydrolysates was almost unaffected by the type of raw material, but could be controlled by the type and degree of hydrolysis. ELC

## 26

**[Standard for glucose syrup.]**

Thailand, Thai Industrial Standards Institute  
*Thai Standard* TIS 268, 38pp. (1978) [Th] [Min. of Ind., Bangkok 4, Thailand]

## 27

**[Standard for dextrose monohydrate.]**

Thailand, Thai Industrial Standards Institute  
*Thai Standard* TIS 270, 17pp. (1978) [Th] [Min. of Ind., Bangkok 4, Thailand]

## 28

**[Standard for dextrose anhydrous.]**

Thailand, Thai Industrial Standards Institute  
*Thai Standard* TIS 307, 26pp. (1979) [Th] [Min. of Ind., Bangkok 4, Thailand]

## 29

**Computer evaluation of the results of batch fermentations.**

Nyeste, L.; Sevelle, B.

*Acta Alimentaria* 9 (3) 225-236 (1980) [10 ref. En]  
[Dep. of Agric. Chem. Tech., Tech. Univ. of Budapest, H-1521 Budapest, Gellert ter 4, Hungary]

A useful aid in the mathematical modelling of fermentation systems, in the kinetic evaluation of batch fermentations, is described. The generalized logistic equation, as suggested, may be used to describe the growth curves, substrate consumption and product formation. A computer process was developed to fit the equation to experimental points, automatically determining the equation constants on the basis of the iteration algorithm of the method of non-linear least squares. By fitting the process to different master programmes of various fermentations, complex kinetic evaluation of the fermentations becomes possible. Based on the analytically easily treatable generalized logistic equation, it is possible to calculate by computer different kinetic characteristics: e.g. rates, specific rates, yields, etc. The possibility of committing subjective errors, so common in kinetic evaluation, was reduced to a min. Employment of the method is demonstrated on some fermentation processes [using sorbose, glucose], and problems arising during the course of application are discussed. AS

## 30

**[Functional characteristics of glucose syrups, with special reference to their use in manufacture of boiled sweets, toffees and chewable sweets.]**

Funktionelle Eigenschaften der Glukosesirupe mit Rücksicht auf ihre Anwendung für die Herstellung von Hartkaramellen, Weichkaramellen und Kaubonbons. Cooman, H. de; Pelgroms, J.

*Zucker- und Süßwarenwirtschaft* 33 (7/8) 244-248 (1980) [De]

The composition (sugar spectrum, and DM, N, ash, SO<sub>2</sub>, heavy metal and Cl contents) and characteristics (colour, average mol. wt., viscosity, conductivity, dextrose equivalent, solubility, osmotic pressure,  $a_w$ , b.p., and sweetness) of glucose syrups are discussed with reference to tables of data for various commercially available glucose syrups (including high-fructose types). Characteristics of importance for use of glucose syrups in manufacture of confectionery are discussed, with reference to effects on transparency, colour, adhesiveness, undesirable crystallization, structure and density of the products, and selection of glucose syrups for optimum product quality is briefly considered. AJDW



## 31

**High-performance liquid chromatographic method for the analysis of D-arabino-2-hexosulose (D-glucosone).**

Geigert, J.; Hirano, D. S.; Neidleman, S. L.  
*Journal of Chromatography* 202 (2) 319-322 (1980)  
[6 ref. En] [Cetus Corp., 600 Bancroft Way, Berkeley, California 94710, USA]

A new process for manufacture of crystalline fructose from glucose [US Patent Application Serial No. 42219 (1979)] utilizes a combined enzymic oxidation and chemical reduction reaction. The key intermediate is D-glucosone, but this is unstable and difficult to measure. A rapid method for measurement of D-glucosone is described, using HPLC and a carbohydrate analysis column, with 20% aqueous acetonitrile as mobile phase buffered at pH 6.0 with 0.003M potassium phosphate and dual detectors using refractive index and UV at 192 nm. Acidic buffering is an essential feature to prevent decomposition of D-glucosone. Min. detection of D-glucosone is 20 µg (refractive index) and 0.1 µg by UV, and precision is 10.1% s.d. The method also detects D-glucose, D-fructose, D-gluconic acid, and D-2-ketogluconic acid. Detection of low levels of D-glucose is important as their presence interferes with fructose crystallization. ELC

## 32

**[Process for making glucose.]**

Baltsere, D. Yu.; Aren, A. K.; Daiya, D. Ya.  
*USSR Patent* 767 208 (1980) [Ru]

Process for making glucose comprises hydrolysing cellulose with an enzymic preparation covalently bonded to a carrier. To increase the glucose yield and reduce consumption of the enzymic preparation the carrier is a copolymer of vinylpyrrolidone and acrolein, and the ratio of cellulose to fermenting composition is 1:0.01-0.02. W&Co

## 33

**A simple colorimetric method for the determination of sugars in fruit and vegetables.**

Blakeney, A. B.; Mutton, L. L.  
*Journal of the Science of Food and Agriculture* 31 (9) 889-897 (1980) [19 ref. En] [Agric. Res. Cent., Yanco, NSW 1703, Australia]

A rapid, manual colorimetric method for determining glucose, fructose and sucrose in fruit and vegetables is described. The method is based on detn. of reducing sugars before and after invertase digestion using *p*-hydroxybenzoic acid hydrazide. Total fructose (fructose + fructose in sucrose) is determined using 2-thiobarbituric acid and the component sugars calculated. Addition of sugars to fruit extracts gave good recoveries (97.4-101.8%) for glucose, fructose and sucrose. AS

## 34

**[Sucrose, glucose and fructose in concentrated orange juices from fruits of Piana di Rosarno.]**  
[Lecture]

Calvarano, M.; Schachter, S.; Giacomo, A. di  
*Essenze Derivati Agrumari* 48 (4) 381-389 (1978)  
[10 ref. It] [Sta. Sperimentale per l'Ind. delle Essenze e dei Derivati Agrumari, Reggio Calabria, Italy]

Sucrose, glucose and fructose concn. were determined in 24 samples of conc. orange juice from batches produced during the 1977/1978 season from cv. Biondo Commune of the Piana di Rosarno. Juices were diluted to 11.18°Brix, and sugars were determined enzymically. Tabulated results showed sucrose concn. of 1.61-3.85% in 11.18°Brix juice (mean 2.77%), equivalent to 20.53-44.81% of total sugars (mean 36.89%); glucose 1.94-3.10% (mean 2.40%), or 26.94-40.68% (30.91%); fructose 2.02-3.17% (mean 2.50%), or 28.25-40.89% (32.18%); and glucose:fructose ratio 0.828-1.135 (mean 0.961). [See FSTA (1981) 13 6J839.] RM

## 35

**Glucose isomerization.**

Ehrenthal, I.; Slapshak, L. F.; Rajpara, J. (Anheuser-Busch Inc.)

*United States Patent* 4 230 802 (1980) [En]

Process for converting glucose to fructose employs a glucose isomerizing enzyme with a starch conversion mud comprising fatty acids, esterified fatty acids, coagulated proteins and hemi-cellulose. IFT

## 36

**[Process for making glucose.]**

Maksimov, V. I.; Mosin, V. A.; Maksimova, G. N.; Vorob'eva, G. I.; Losyakova, L. S. (Union of Soviet Socialist Republics, Vsesoyuznyi Nauchno-issledovatel'skii Biotekhnicheskii Institut)  
*USSR Patent* 761 563 (1980) [Ru]

Process for making glucose from insoluble yeast residues comprises hydrolysing them with an enzyme from *Aspergillus foetidus* or *Asp. awamori*. To increase product yield 1-2 parts of the enzyme from *Asp. awamori* or *Asp. foetidus* is mixed with 3-6 parts of a cellulose complex produced by the fungi *Trichoderma koningii*, *T. lignorum* or *Geotrichum candidum*. W&Co

## 37

**[Separation of starch molecules by high pressure liquid chromatography.]** Trennung von Stärkemolekülen durch Hochdruckflüssigkeitschromatographie.  
Meuser, F.; Klingler, R. W.; Niediek, E. A.  
*Getreide, Mehl und Brot* 33 (11) 295-299 (1979)  
[14 ref. De] [Tech. Univ. Berlin, Inst. für Lebensmitteltech. - Getreidetechn. - Seestrass 11, 1000 Berlin 65]

In order to characterize molecular structure of chemically modified starches, a high pressure liquid gel permeation chromatographic (HPL-GPC) technique was developed for separation of high and low mol. wt.



glucose polymers. The method is based on use of columns packed with porous glass spheres. Effects of pore size on carbohydrate separation are discussed, and it is shown that by partial enzymic hydrolysis of modified starches, dispersal of the products under mild conditions in dimethyl sulphoxide and separation using a combination of column packings, rapid and simple characterization of structure is enabled. DIH

### 38

**Formation of mutagens by heating the aqueous solution of amino acids and some nitrogenous compounds with addition of glucose.**

Yoshida, D.; Okamoto, H.

*Agricultural and Biological Chemistry* 44 (10) 2521-2522 (1980) [9 ref. En] [Cent. Res. Inst., Japan Tobacco & Salt Public Corp., 6-2 Umegaoka, Midori-ku, Yokohama 227, Japan]

Formation of mutagens during refluxing of aqueous solutions of N compounds and glucose was studied using 1 of 17 amino acids, creatine, adenine or albumin in the presence of 0.5M glucose for 8 h. Mutagenicity was assayed using *Salmonella typhimurium* TA98 or TA100 with or without S9 mix. Arginine, lysine and creatine gave mutagenic products with TA98 + S9, and lysine did with TA100 + S9. The refluxed solution of creatine + glucose showed 5% of the mutagenic activity of benzo(a)pyrene, and creatine would be expected to be present at greater concn. in meat than free amino acids. Mutagens may be present in commercial beef extracts. DIH

### 39

**[Effect of type of carbohydrate on course of dry sausage ripening.]** Beitrag zum Einfluss der Kohlenhydratart auf den Verlauf der Rohwurstreifung. Klettner, P.-G.; List, D.

*Fleischwirtschaft* 60 (9) 1589-1590, 1592-1593; 1701 (1980) [19 ref. De] [Bundesanstalt für Fleischforschung, 8650 Kulmbach, Federal Republic of Germany]

The effect of various carbohydrates as control parameters for sausage ripening was studied. 0.5% glucose, sucrose, dry starch syrup, lactose and potato starch were added to model emulsions with starter cultures, and effects on pH, lactic acid concn., firmness, water content and water activity ( $a_w$ -value) of the products determined. Sausage ripening was delayed by the carbohydrate additions in the order as above, as shown by the degree of pH drop, lactic acid formation and increase in firmness. pH value is an index of acidification as well as of proteolysis, while breakdown of carbohydrates is shown by lactic acid formation. Increase in firmness provides further information on the specific effect of the acidification phase: early acidification has a significant effect on firmness and water loss. Correlations between the various parameters, tabulated for wk 1 and wk 2-4 of ripening, showed close correlations between water content and  $a_w$ -value, and between firmness and all the other parameters. Sensory tests showed no difference between products made with glucose, sucrose, starch syrup or lactose, while potato starch produced an untypical, unsufficiently acid flavour. RM

### 40

**[Kinetic chemiluminescence method for determination of jointly present micro amounts of lactose and glucose using immobilized enzymes.]**

Rigim, V. I.

*Zhurnal Analiticheskoi Khimii* 34 (4) 799-804 (1979) [19 ref. Ru] [Krasnoyarskii Filial Vses. Nauchno-issled. Inst. Stroitel'nykh Materialov & Konstruktsii, Krasnoyarsk, USSR]

A method is described involving hydrolysis of lactose to galactose and glucose by immobilized  $\beta$ -galactosidase, oxidation of glucose to gluconic acid and  $H_2O_2$  by immobilized glucose oxidase, and detn. of  $H_2O_2$  using a bis(3,4,6-trichlorophenyl) oxalate/9,10-diphenylanthracene/trimethylamine reagent and measurement of chemiluminescence. The method enables joint detn. of  $\geq 6$  ng glucose and  $\geq 12$  ng lactose; it is not affected by the presence of any of 11 carbohydrates frequently encountered in biological material, even in 1:10 000 excess. SKK

### 41

**High-performance-liquid-chromatographic determination of carbohydrates in soft drinks.**

Vidal-Valverde, C.; Martin-Villa, M. C.; Herranz, J.; Rojas-Hidalgo, E.

*Zeitschrift für Lebensmittel-Untersuchung und -Forschung* 172 (2) 93-95 (1981) [17 ref. En, de] [Nutr. Dep., Univ. Autonoma, San Martin de Porres 4, Madrid 35, Spain]

An HPLC method for detn. of glucose, fructose and sucrose in soft drinks is described. Beverages are degassed, neutralized with  $CaCO_3$ , and filtered, and aliquots of the filtrate having 40-80 mg of each sugar are evaporated to dryness, dissolved in 6.25 ml distilled water and made up to 25 ml with acetonitrile. Samples are filtered and injected directly onto a  $\mu$ -Bondapak carbohydrate column, eluting with acetonitrile/water (75:25); a differential refractometer detector is used. A number of commercial soft drinks were analysed by this technique and mean contents of individual carbohydrates are tabulated for each brand. Contents of total sugars found in the following classes of drink were (g/100 ml): cola 4.77-10.74; lemon 4.32-11.35; orange 4.54-12.84; bitter 10-81; chufa orgeat [tiger-nut-drink] 10.89; and tonic water 8.78. Results for total sugars agreed well with those from a column chromatographic method for total sugars. DIH

### 42

**[Energy aspects of the competition between sucrose and isoglucose.]** Energetische Untersuchungen zur Wettbewerbssituation zwischen Saccharose und Isoglukose.

Fenner, J.

*Zuckerindustrie* 105 (11) 979-985 (1980) [7 ref. De, en, es, fr] [Schwaigerner Strasse 21, 6927 Bad Rappenau, Federal Republic of Germany]

The manufacture of the rival sweeteners sucrose (from sugar beet) and isoglucose (from potatoes, wheat and maize) is associated with considerable energy expenditure. The essential energy factors for agricultural production, transport and processing are



derived and discussed with regard to the competition between the 2 sweeteners (as well as other influencing factors). It is shown that from the point of view of energy isoglucose has a slight advantage, although there are differences depending on the raw material. Energy savings seem possible at all stages, especially during processing. AS

#### 43

[Energy analysis for the raw materials for the competing sweeteners sucrose and isoglucose.]  
Energieanalysen für Rohstoffe der konkurrierenden Süßungsmittel Saccharose und Isoglukose.  
Fenner, -.

*Berichte über Landwirtschaft* 57 (3) 431-447 (1979)  
[27 ref. De, en, fr] [Lehrstuhl für Wirtschaftslehre des Landbaues, Tech. Univ. München, 8050 Freising-Weihenstephan, Federal Republic of Germany]

Agricultural energy and capital costs of production of sugar beet are compared with those of production of potatoes, wheat and corn (raw materials for isoglucose production). Energy costs of production of raw materials (i.e. not including transport and subsequent into sweeteners) are as follows (kg sugar equivalent/GJ): sugar beet 210, potatoes 179, wheat 104, corn 83 (figures based on mean yield figures for the Federal Republic of Germany). Distribution of energy and capital costs among the production states drying, plant protection, fertilization, seed, and tractor fuel shows that corn, because of the energy intensive drying process necessary, would be the most adversely affected by future increases in fuel costs. DIH

#### 44

Dextrose - Determination of loss in mass on drying - Vacuum oven method.  
International Organization for Standardization

*International Standard ISO 1741:1980*, 2pp. (1980)  
[En]

The method is applicable to anhydrous dextrose and to dextrose monohydrate, and involves drying a test portion in a vacuum oven at 100°C at a pressure  $\leq 135$  mbar (1 mbar = 0.1 kPa). AL

#### 45

Determination of glucose by modification of Somogyi-Nelson method.  
Hatanaka, C.; Kobara, Y.

*Agricultural and Biological Chemistry* 44 (12) 2943-2949 (1980) [10 ref. En] [Dep. of Applied Biochem., Hiroshima Univ., Fukuyama 720, Japan]

A modification of the Nelson-Somogyi method [see *Journal of Biological Chemistry* (1952) 195, 19] for detn. of glucose is described. The arsenomolybdate reagent is replaced by Folin-Ciocalteu (FC) phenol reagent (to overcome toxicity problems) at various dilutions. Although the FC reagent gives less colour, the results are more reproducible and stable. Conc'n. of FC did not affect results significantly, and a wavelength of 660 nm was decided on for measuring the coloured product (500-800 nm were tested). Errors in the original and modified method could be reduced by 75% by adding sodium benzoate to the test solutions. LH

#### 46

[Continuous determination of sugars in condensed water.]

Takatori, Y.; Toyama, R.; Takezaki, T.

*Proceedings of the Research Society of Japan Sugar Refineries Technologists [Seito Gijutsu Kenkyukai-shi]* 25, 47-52 (1975) [Ja. en]

When condensed water containing sucrose is heated at high temp. and pressure, its electrical conductivity is much higher than that of normal water. This finding was utilized in the development of a procedure for the continuous detection of sugars in condensed water. The detector developed, which is simple to operate and maintain, consists of a pressure pump, heating pipe, cooling pipe and equipment for determining the electrical conductivity. Using condensed water containing 0-50 p.p.m. sucrose, the detector was operated under the following conditions: pressure in heating tube, 20 kg/cm<sup>2</sup>; temp. at heating tube outlet, 265°C; retention time of sample in heating tube, 2.5 or 5 min. A retention time of 5 min gave higher electrical conductivity values than a retention time of 2.5 min. With a retention time of 5 min, a linear relationship was found between electric conductivity and sucrose content in the range 0-10 p.p.m., 1 p.p.m. of sucrose corresponding to 1.8  $\mu$ mho/cm electrical conductivity. Further studies indicated that this procedure can also detect glucose, fructose, cows' milk, formalin and starch. [From En summ.] JA

#### 47

Immobilized glucose isomerase on DEAE cellulose beads.

Chen, L. F.; Gong, C. S.; Tsao, G. T.

*Starch/Stärke* 33 (2) 58-63 (1981) [14 ref. En, de] [Lab. of Renewable Resources Eng., Purdue, Univ., W. Lafayette, IN 47907, USA]

Purified glucose isomerase from *Actinoplanes missouriensis* was immobilized on porous DEAE cellulose beads by simple adsorption. The immobilized enzyme retained >70% of its original activity. The hindrance of the immobilized enzyme activity by pore

diffusion and film diffusion was insignificant at bead size  $\leq 35$  mesh. The relative substrate flow rate can be kept at  $\geq 0.04$  cm/s. The optimum pH did not change with immobilization, but optimum pH range (pH profile) became broader, indicating that immobilized enzyme was less sensitive to pH change than the soluble enzyme. The half-life of the immobilized enzyme was about 1000 h at 60°C. Co ions were not required for stability. The cost of using immobilized enzyme on DEAE cellulose beads should be less than that of the whole cell immobilization systems, due mainly to the possibility of reusing DEAE cellulose beads for immobilization as well as for enzyme purification. [See also *Biotechnology & Bioengineering* (1980) 22, 833.] AS

#### 48

Regulation of aflatoxin biosynthesis: characterization of glucose as an apparent inducer of aflatoxin production.

Abdollahi, A.; Buchanan, R. L.

*Journal of Food Science* 46 (1) 143-146 (1981) [16 ref. En] [Dep. of Nutr. & Food Sci., Drexel Univ., Philadelphia, Pennsylvania 19104, USA]



Aflatoxins were not produced when *Aspergillus parasiticus* was cultured on medium containing peptone plus mineral salts. Transferring the microorganism to a glucose-containing medium resulted in aflatoxin production. Initiation of aflatoxin synthesis could be blocked by treatment with cycloheximide or actinomycin D. It appears that glucose or a product of its metabolism, acting at the transcriptional level, induces  $\geq 1$  of the enzymes responsible for aflatoxin synthesis. IFT

## 49

**HPLC determination of fructose, glucose and sucrose in potatoes.**

Wilson, A. M.; Work, T. M.; Bushway, A. A.; Bushway, R. J.

*Journal of Food Science* 46 (1) 300-301 (1981) [12 ref. En] [Food Sci. Dep., Univ. of Maine, Orono, Maine 04469, USA]

The HPLC system consisted of a  $\mu$ Bondapak/carbohydrate column, a solvent system of acetonitrile-water (75:25) with a flow rate of 1.8 ml/min, and a refractive index detector. Analysis, including sample preparation, was complete in 30 min. With the exception of high concn. of sucrose ( $\geq 8$  mg/g) the method recovered  $\geq 93\%$  of all sugars. Coeff. of variation for the procedure ranged from 1.39 to 13.31%. TLC indicated that there were no interfering compounds eluting with any of the 3 sugars. IFT

## 50

**Predicting concentrations of individual sugars in dry mixtures by near-infrared reflectance spectroscopy.**

Giangiacomo, R.; Magee, J. B.; Birth, G. S.; Dull, G. G. *Journal of Food Science* 46 (2) 531-534 (1981) [10 ref. En] [USDA Richard B. Russell Agric. Res. Cent., SEA-AR, Athens, Georgia 30613, USA]

To support research in nondestructive quality evaluation of fruits and vegetables, near IR reflectance spectroscopy was used to measure concn. of fructose, glucose, and sucrose in model systems intended to represent the major constituents of dried apple tissue. Spectra (950-1850 nm) of a series of known samples were recorded, and multiple linear regression techniques were used to relate the concn. of each sugar to reflectance measurements at selected wavelengths. Reflectance measurements at 3 computer-selected wavelengths for each sugar were used to predict the concn. in an independent set of samples. Correlation coeff. for actual vs. predicted values were 0.995 for fructose, 0.994 for glucose, and 0.986 for sucrose, while the respective standard errors computed as variation from the regression lines were 1.48, 1.39 and 1.44%. IFT

## 51

**Process for the simultaneous production of fructose and gluconic acid from glucose-fructose mixtures.**

Müller, H.-R.; Kündig, W.; Hedinger, A. (Merck Patent GmbH)

*United States Patent* 4 242 145 (1980) [En]

Process is described for the simultaneous production of fructose and of gluconic acid from glucose-fructose mixtures and/or from invert sugar by the selective oxidation of the glucose proportion, where  $O_2$  and/or air, activated by noble metal catalysts, are utilized as the

oxidizing agents; the oxidation is conducted in a pH range of approx 8-10; and the oxidation is terminated after the formation of 1 equivalent of carboxylic acid/mol of glucose employed. The gluconic acid obtained can then be separated from the unchanged fructose simply and quantitatively, and can be isolated as the salt. AS

## 52

**Potentiometric determination of D(+) glucose, D(+)mannose or D(-)fructose in a mixture of hexoses and pentoses, by using *Streptococcus mutans* fermentation.**

Grobler, S. R.; Wyk, C. W. van

*Talanta* 27 (7) 602-604 (1980) [20 ref. En] [Dep. of Pedodontics and Chem. Analysis, Univ. of Oslo, Geitmyrsvn 71, Oslo 4, Norway]

A potentiometric sensor has been developed based on selective fermentation of carbohydrates by *Streptococcus mutans*. This combination of bacterial action and a glass electrode responds to  $\beta$ -D(+)glucose, D(+)mannose and  $\beta$ -D(-)fructose over a narrow concn. range, with a response time of 4 min, and has negligible response to other hexoses and pentoses. AS

## 53

**Starch hydrolysate.**

APV Co. Ltd.

*UK Patent Application* 2 045 764A (1980) [En]

Process is described for the continuous production of glucose syrup by the enzymic hydrolysis of starch slurry, and ultrafiltration of the reaction mixture. IFT

## 54

**[Glucose isomerizing enzymes and their properties.] [Review]**

Demnerova, K.; Valentova, O.; Kas, J.

*Chemické Listy* 74 (6) 618-628 (1980) [77 ref. Cs, en] [Katedra Biochem. a Mikrobiol. VSCHT, Prague, Czechoslovakia]

A survey is given of enzymes capable of isomerizing glucose to fructose and their properties. The greatest attention is paid to D-xylose-ketol-isomerase (EC 5.3.1.5) which is used in industrial isomerization of glucose. A review of microorganisms from which the glucose isomerizing enzymes can be isolated is also presented. STI

## 55

**A novel reaction of sugars with anion radical of carbon dioxide produced from formate.**

Kito, Y.; Kawakishi, S.; Namiki, M.

*Agricultural and Biological Chemistry* 44 (11) 2695-2701 (1980) [12 ref. En] [Dep. of Food Sci. & Tech., Nagoya Univ., Chikusa-ku, Nagoya 464, Japan]

Radiolysis of some monosaccharides (fructose, glucose and ribose) in air-free conditions was markedly enhanced by the addition of formate at concn.  $> 20$  mM, and inhibited at concn.  $< 20$  mM. The following compounds were detected in the irradiated sugar solutions containing excess formate (100 mM): 1-deoxy-D-arabinohexulose and 1,3-dideoxy-D-erythrohexulose from fructose; 2-deoxy-D-ribose and 2-deoxyribitol from ribose; and 2-deoxy-D-glucose and 2-deoxy-D-



glucitol from glucose. A mechanism for radiolytic formation of the products is proposed, based on interaction of,  $\text{CO}_2^-$  formed from formate with sugars. AS.

## 56

[Dried glucose syrup.]

Arab Organization for Standardization & Metrology  
*Arabian Standard* ASMO 371, 5pp. (1978) [Ar]  
[25 Iraq Street, PO Box 27, Dokki, Cairo, Egypt]

## 57

[Effect of glucose on lysinoalanine formation.]

Murase, M.

*Journal of the Agricultural Chemical Society of Japan [Nihon Nogei Kagakkai-shi]* 54 (1) 13-19 (1980)  
[19 ref. Ja, en] [Food Res. Inst., Aichi Prefectural Government, 2-1 Shimpukuji-cho, Nishi-ku, Nagoya 451, Japan]

Lysinoalanine (LAL) formation was partially inhibited by D-glucose, and the extent of inhibition of LAL formation was directly dependent on the glucose/protein ratio. Among glucose derivatives examined, compounds with free carbonyl groups showed partial inhibition of LAL formation, which was also dependent on the glucose derivatives/protein ratio. Inhibition of LAL formation by glucose and its derivatives was always accompanied by brown colour development, probably due to amino-carbonyl reactions. Positive correlations between the extents of inhibition of LAL formation and those of brown colour development were observed. The pH and temp. during the alkaline treatments influenced inhibition of LAL formation. With increase in temp., LAL formation also increased. The highest inhibition of LAL formation was attained at pH 11.0-12.0. Lysine contents of alkaline-treated proteins also decreased with increasing glucose:protein ratio. Decomposition of cystine and/or cysteine estimated for cysteic acid was not affected by glucose. D-Glucose-L-cysteine inhibited LAL formation. These results suggest that inhibition of LAL formation by glucose is due to the decrease in the concn. of  $\epsilon$ -amino group of lysine residues participating in the amino-carbonyl reaction. AS

## 58

[Determination of carbohydrates in multicomponent solutions by enzymic-glucose electrode.]

Kulis, Yu. Yu.; Peslyakene, M. V.

*Zhurnal Analiticheskoi Khimii* 35 (6) 1168-1173 (1980) [9 ref. Ru, en] [Inst. Biokhimii AN LitSSR, Vil'nyus, USSR]

Procedures are described for detn. of glucose, sucrose and lactose (0.01-1 mM) in multicomponent solutions by means of an electrode cell consisting of a platinum anode covered by membranes carrying glucose oxidase and a Ag/AgCl reference electrode. Glucose is determined within 1 min by measuring the steady state current, or within 12 s by recording the current under kinetic conditions. STI

## 59

Continuous ethanol production by immobilized yeast reactor.

Linko, Y.-Y.; Linko, P.

*Biotechnology Letters* 3 (1) 21-26 (1981) [26 ref. En] [Helsinki Univ. of Tech., SF-02150 Espoo 15, Finland]

*Saccharomyces cerevisiae* immobilized in calcium alginate gel beads, was employed in packed-bed column reactors for continuous ethanol production from glucose or cane molasses, and for beer fermentation from barley malt wort. With properly balanced nutrient content or periodical regeneration of cells by nutrient addition and aeration, ethanol production could be maintained for several months. About 7% (w/v) ethanol content could be easily maintained with cane molasses diluted to about 17.5% (w/v) of total reducing sugar at 4-5 h residence time. Beer of up to 4.5% (w/v) of ethanol could be produced from barley wort at about 2 h residence time without any addition of nutrients. AS

## 60

[Sugars in beverages and their sweet flavour.]

Rapaille, -.; Walon, -.; Granier, -.; Simon, -.

*Industrie delle Bevande* 10 (5) 400-402 (1980) [It] [Cent. di Ricerca CPC-Europa, Vilvoorde, Belgium]

Relative sweetness of 9 sugars at 5, 10 and 15% concn. (pH 5.2, 20°C) was compared with that of sucrose by a skilled test panel at the CPC-Europa Research Centre, Vilvoorde, Belgium. Relative sweetness (sucrose 100) was also determined for sucrose mixtures with dextrose, glucose syrups (39-61 DE), isomerized syrup (42% levulose) and various invert syrups. Results are presented in tables and graphs. Sweetness generally increased with increasing concn. With mixtures a definite synergistic effect was shown i.e. actual sweetness values were higher than the theoretical values calculated from the sweetness data of the individual sugars. Thus, for mixtures containing 40% sucrose actual vs. theoretical relative sweetness values were dextrose 90 and 85, glucose syrup (DE 60) 77 and 72, and isomerized syrup 101 and 92. Relative sweetness increased with degree of inversion up to 50%, then decreased. Application to non-alcoholic citrus-based beverages showed that the high acidity (pH 2.2-2.8) caused considerable sucrose inversion during storage e.g. 75% after 3 months. In beverages containing sucrose the sweetness may vary by 12-13% as the inversion rate increased from 50 to 100%. The best balance for limiting is considered to be 80% sucrose with 20% dextrose. ELC

## 61

[The fundamental relationship between the solubility, the boiling point and the crystallization of sucrose.]

Blyselbout, P.

*Revue des Industries de la Biscuiterie, Biscotterie, Chocolaterie, Confiserie* No. 36, 14-25 (1980) [Fr]

The physical behaviour of sucrose solutions is described, including discussion of the solubility curve of pure sucrose, and the factors affecting solubility, e.g. temp., viscosity and granularity of the sugar crystals. In general, the presence of other compounds reduces



sucrose solubility; in particular this is relevant in cases where glucose and inverted sucrose solutions are considered. Crystallization behaviour is dependent on degree of supersaturation of the solution; the zones of stability, metastability and lability of sucrose solutions are illustrated. Crystallization is also affected by viscosity; in highly viscous supersaturated solutions the rate of crystallization is so reduced as to render the system practically stable. Tables are presented of the b.p. of 50:50 sucrose/glucose syrups with DE of 36, 42 and 64 at concn. of 0-99% DM, and of pure sucrose and glucose solutions. JRR

## 62

**Biotechnical research into production of glucose-fructose syrups. IV. Production and characterization of immobilized glucoamylase.**

Hollo, J.; Laszlo, F.; Hoschke, A.

*Starch/Stärke* 33 (2) 52-55 (1981) [18 ref. En, de] [Univ. of Tech. Sci., Gellert Ter 4, 1521-Budapest, Hungary]

Cellulose amine and DEAE-cellulose were investigated as potential carriers for *Aspergillus niger* glucoamylase, with glutaraldehyde and/or *p*-benzoquinone as binding agents. Results, shown graphically and in tables, indicated that for cellulose amine the best coupling was achieved with the smallest particle size (0.03 mm). For DEAE-cellulose, the amount of enzyme bound depends on the swelling of the carrier, and binding could be observed even in the pores of the DEAE-cellulose. [See FSTA (1979) 11 8L528 for part III.] RM

## 63

**The isomerization of D-glucose into D-fructose catalyzed by whole-cell immobilized glucose isomerase. The dependence of the intrinsic rate of reaction on substrate concentration, pH, and temperature.**

Kikkert, A.; Vellenga, K.; Wilt, H. G. J. de; Joosten, G. E. H.

*Biotechnology and Bioengineering* 23 (5) 1087-1101 (1981) [27 ref. En] [Chem. Eng. Lab., Univ. of Groningen, Nijenborgh 16, 9747 AG Groningen, Netherlands]

The relation between the intrinsic rate of glucose-fructose isomerization catalysed by whole-cell immobilized glucose isomerase and the substrate concn. is described in a kinetic model (given). Numerical values in the model were determined from low-conversion experiments starting from pure glucose or fructose solutions, and are presented as a function of pH and temp. Numerous tables, graphs and formulae are given. AL

## 64

**Process for the production of fructose.**

Neidلمان, S. L.; Amon, W. F., Jr.; Geigert, J. (Cetus Corp.)

*United States Patent* 4 246 347 (1981) [En]

Process is described for the production of fructose from glucose. An aqueous solution of glucose is converted to D-glucosone by an enzymic process. D-

Glucosone is then converted to virtually pure fructose by chemical hydrogenation. Fructose may be recovered in crystalline form. AS

## 65

**Low-moisture, frangible aerated confections and method of preparation.**

Gajewski, R. J. (General Mills Inc.)

*United States Patent* 4 251 561 (1981) [En]

Aerated, dextrose-based confections and methods for their preparation are described. The confections comprise approx. 87%-99% dextrose, approx. 0.5-3% whipping agent e.g. gelatin, egg white, protein hydrolysates from caseinate, whey etc. and approx. 0.5-7% moisture. In 1 method a confection melt is prepared from melted dextrose monohydrate and a whipping agent such as hydrated gelatin. The confection melt of specified temp. range (190-270°F) is pumped through a whipper so as to aerate the mixture to particular densities (0.2-1.0 g/cm<sup>3</sup>). The composition is simultaneously cooled to achieve particular whipper exit temp. (160-220°F). The aerated confection is then formed into pieces of desired shape and size and cooled. 1 embodiment of the edible aerated confection is suitable for use as blackboard chalk, and so is particularly suitable as a product for young children: Mardexx chalk was prepared, containing 98.2 wt. % dextrose, 0.8 wt. % gelatin and 1.0 wt. % moisture. AS

## 66

**Elimination of glucose in egg white by co-immobilized glucose oxidase and catalase.**

Kobayashi, T.; Ban, T.; Shimizu, S.; Ohmiya, K.; Shimizu, S.

*Journal of Fermentation Technology [Hakko Kagaku Zasshi]* 56 (5) 506-510 (1978) [5 ref. En] [Dep. of Food Sci. & Technol., Fac. of Agric., Nagoya Univ., Nagoya 464, Japan]

Glucose oxidase and catalase were immobilized together or separately by using polyacrylamide gel, and their characteristics were compared. For elimination of glucose in egg white, the gel immobilized together was superior to the gel immobilized separately. Oxidation of glucose to gluconic acid was found to follow the Michaelis-Menten kinetics. AS

## 67

**[New findings in the oxidation of glucose by means of immobilized glucose oxidase.] Neue Erkenntnisse bei der Glucoseoxidation mit immobilisierter Glucoseoxidase.**

Hartmeier, W.

*Starch/Stärke* 33 (3) 97-102 (1981) [18 ref. De, en] [C. H. Boehringer Sohn, Postfach 200, D-6507 Ingelheim, Federal Republic of Germany]

Recent aspects affecting the economical technical use of the immobilized glucose oxidase catalase system (e.g. for removal of O<sub>2</sub> from beverages) are discussed. Trials of continuous processing were unsuccessful, as the conversion rates were insufficient and technical difficulties arose in keeping back the enzyme particles in the reactor. Batch processing trials with repeated use



of enzyme revealed the importance of maintaining optimal  $O_2$  supply and low temp. (around  $2^\circ C$ ). Different types of stirred tank reactors were tested and classified for their suitability. The large-scale application of enzymic glucose oxidation in an aerated batch-type reactor seems promising. [From En summ.] RM

## 68

**Process for immobilizing glucose isomerase and a method of continuous isomerization of glucose.**  
Enokizono, S.; Ushiro, S. (CPC International Inc.)  
*United States Patent* 4 252 899 (1981) [En]

Glucose isomerase is immobilized in an active form by adsorbing the glucose isomerase onto a colloidal silica. The enzyme is contacted with the colloidal silica and the resulting composite solidified by freezing. Optionally, the composite may be gelatinized prior to freezing. The composite is then used for the isomerization of glucose to fructose. AS

## 69

**[Sugars and saccharimetric degrees.]**

Janssens, G.

*Annales des Falsifications et de l'Expertise Chimique* 73 (786) 299-300 (1980) [Fr]

It is shown that, if a solution of 163 g sucrose/l gives a reading of  $100^\circ$  by saccharimetry, then the reading  $\Delta$  given by a solution containing  $S$  g sucrose/l,  $G$  g glucose/l and  $F$  g fructose/l is given by the equation  $\Delta$  approx. equals  $0.6 S \pm 0.5 G - 0.8 F$ . DIH

## 70

**[Maillard reaction: study in model system containing different amino acids.]** [Thesis; Reacao de Maillard: estudo em sistemas modelo contendo diferentes aminoacidos, 124pp., Pt.]

Toledo, M. C. F.

*Informativo Anual, Faculdade de Engenharia de Alimentos e Agricola, Universidad Estadual de Campinas* No. 8, 53-55 (1980) [Pt, En]

The Maillard reaction was studied in a model system containing glucose (1.25M) and an amino acid (0.66M) at pH 6.2 and 3.0, at  $50^\circ C$ , in the presence or absence of cupric ions; melanoidins were also prepared from the same system at pH 6.2 and  $90^\circ C$ . The reaction was followed by measuring absorbance at 450 nm and determining loss of glucose and primary amino N. At pH 6.2, with or without  $Cu^{2+}$ , browning intensity decreased in the order: lysine > glutamic acid > glycine; the sequence was similar at pH 3.0, without  $Cu^{2+}$  ions, but was altered by their presence. Browning rate was proportional to the characteristic accelerations for each amino acid and for each pH, the time needed for appearance of colour diminishing in the presence of  $Cu^{2+}$ , especially at pH 3.0. IR spectroscopy showed that melanoidins from reaction between glucose and glycine, lysine or glutamic acid contained the same functional groups. KME

## 71

**Immobilized enzymes.**

Ushiro, S. (CPC International Inc.)

*United States Patent* 4 263 400 (1981) [En]

When immobilizing enzymes e.g. glucose isomerase, by adsorption on a carrier, e.g. an ion exchange resin, the enzyme prior to adsorption on the carrier is separated from a high mol. wt., non-dialysable polysaccharide which inhibits adsorption of the enzyme to the carrier. AS

## 72

**Effect of xylitol on some food-spoilage microorganisms.**

Mäkinen, K. K.; Söderling, E.

*Journal of Food Science* 46 (3) 950-951 (1981) [4 ref. En] [Dep. of Biochem., Inst. of Dentistry, Univ. of Turku, SF-20520 Turku 52, Finland]

The effect of 0.5% xylitol, 0.5% glucose, and their mixture on growth and pH of cultures of 6 food-spoilage microorganisms was studied. 0.5% xylitol inhibited most potently the growth of *Clostridium butyricum* and *Lactobacillus bulgaricus*, strongly retarding production of acid by these organisms. 0.5% xylitol also inhibited the growth of *Saccharomyces cerevisiae*, *Escherichia coli*, and *Salmonella typhi*, but not that of *Aspergillus flavus*. Less inhibition was observed with the sugar mixture than with 0.5% xylitol alone. [ $U-^{14}C$ ]xylitol was not taken up by the cells during growth. Combined with the advantageous organoleptic and physiological properties of xylitol, the present results suggest that xylitol may be of value in the preservation of certain foods. IFT

## 73

**[Comparative study of methods used for the determination of glucose:fructose ratio.]**

Ferenczi, S.; Kallay, M.; Bardi, G.

*Borgazdasag* 28 (2) 69-73 (1980) [3 ref. Hu] [1221 Budapest, Pentz Karoly u.5, Hungary]

Comparative studies on analysis of wine samples by a 'rapid' polarimetric method and the Boehringer (Mannheim) enzyme test combination method for detn. of the glucose:fructose ratio showed the enzymic method to be more reliable. ESK

## 74

**[Properties of melanoidins obtained by reaction between glucose and glycine.]** [Thesis; Propriedades de melanoidinas obtidas por reacao entre glucose e glicina, 114pp., Pt.]

Leite, S. R. A.

*Informativo Anual, Faculdade de Engenharia de Alimentos e Agricola, Universidad Estadual de Campinas* No. 8, 24-26 (1980) [Pt, En]

Melanoidins were prepared from reaction of D-glucose (concn., 1.35M and 2.50M) with glycine (concn., 0.66M and 1.32M) at pH 3.0 and 6.0 and at  $70^\circ$ ,  $80^\circ$  and  $90^\circ C$ . Melanoidins obtained at pH 3 were poorly soluble; those obtained at pH 6 were water-soluble, interacted with metallic ions, had mol. wt. of from  $8.3 \times 10^3$  to  $> 100\,000$ , and inhibited growth of *Staphylococcus aureus* S6. All the melanoidins had approx. 5% N, 47.8-57.8% C and 4.5-5.7% H. KME



## 75

The analysis and control of some less desirable flavor-contributing components of corn syrup. (In *The analysis and control of less desirable flavors in foods and beverages* [see FSTA (1981) 13 12G820]) [Lecture]

Kiser, D. L.; Hagy, R. L.; Olson, R. L.  
pp. 71-93 (1980) [37 ref. En] [Grain Processing Corp., Muscatine, Iowa, USA]

The production of corn syrup is described and examples are given of how liquid chromatography can be used by manufacturers and their customers to ensure that corn syrup with the desired flavour characteristics for particular food products are produced. Experimental aspects and results as regards carbohydrate profiles (sweetness, non-fermentable content, mol. wt. distribution, browning potential, and process monitoring),  $\text{SO}_2$ , hydroxymethylfurfural and other aldehydes, and yeast and mould growth are described. AL

## 76

Optimization of operating temperature for continuous glucose isomerase reactor system.

Park, S. H.; Lee, S. B.; Ryu, D. D. Y.

*Biotechnology and Bioengineering* 23 (6) 1237-1254 (1981) [35 ref. En] [Korea Advanced Inst. of Sci., PO Box 150, Chung-Ryang-Ri, Seoul, S. Korea]

A continuous process of converting D-glucose to D-fructose by immobilized glucose isomerase was selected as a model system to illustrate the optimal temp. control policy for a packed-bed enzyme reactor system in which the activity of enzyme decreases with time. The kinetic parameters including reduced Michaelis-Menten constant ( $K_m$ ), reduced max. reaction rate ( $V_m$ ), equilibrium constant ( $K_e$ ), and enzyme deactivation constant ( $K_d$ ) and their functional relationships to temp. were determined experimentally. Approx. 8% improvement in fructose productivity was achieved when using the preprogrammed optimal temp. control policy vs. reactor operation at an optimum constant temp. AL

## 77

Enzymatic compositions for isomerizing glucose into levulose.

Lartigau, G.; Bouniot, A.; Guérineau, M. (Rhône-Poulenc Industries)

*United States Patent* 4 264 732 (1981) [En]

Enzymic compositions containing intra-cellular glucose-isomerase which is enclosed in structures based on cellulose ester, their preparation and their use for isomerizing glucose into fructose are described. In addition to the cellulose ester and microorganism cells, e.g. *Streptomyces phaeochromogenes*, these compositions contain a sparingly water-soluble magnesium compound and (optionally) a sparingly water-soluble cobalt compound. These compositions make it possible to isomerize glucose into fructose in a continuous process, with the addition of either no, or a small amount of magnesium ions to the glucose syrup to be isomerized and without the addition of cobalt ions. AS

## 78

Kinetics of the isomerization of D-glucose into D-fructose catalyzed by glucose isomerase containing *Arthrobacter* cells in immobilized and nonimmobilized form

Keulen, M. A. van; Vellenga, K.; Joosten, G. E. H.  
*Biotechnology and Bioengineering* 23 (7) 1437-1448 (1981) [13 ref. En] [Chem. Eng. Lab., Univ. of Groningen, Nijenborgh 16, 9747 AG Groningen, Netherlands]

The kinetic properties of immobilized and nonimmobilized glucose isomerase were investigated. In both cases the kinetics can be described by a modified Michaelis-Menten expression. It appeared that immobilization causes no deactivation. Furthermore, it was shown that the permeability of the cell membrane increases by heat and toluene treatments. AS

## 79

Antioxidant activity of various solvent extracts obtained from a Maillard-type browning reaction mixture.

Won, J.-T.; Kim, D.-H.

*Korean Journal of Food Science and Technology* 12 (4) 235-241 (1980) [35 ref. En, ko] [Dep. of Food Tech., Korea Univ., Seoul 132, S. Korea]

0.2M solutions of glycine + glucose were refluxed at 100°C for 12 h. 10 ml were solvent extracted 5 times (using acetone, benzene, chloroform, diethyl ether, ethanol, methanol, methylene chloride or petroleum ether), dried, concentrated and re-extracted with the same solvent. Samples of each extract were dissolved in soybean oil of peroxide and thiobarbituric acid values (PV and TBA, resp.) of  $1.9 \pm 0.2$  and  $0.2 \pm 0.01$ , and the solvent was evaporated off. Each mixture was incubated at  $45 \pm 1.0^\circ\text{C}$  for 3 wk, and PV and TBA were measured. Antioxidant activities of each extract (estimated on length of induction period, arbitrarily taken as time, in h, for a substrate to reach a PV of 30 mmol/kg oil), were of the order (induction period in parenthesis): ethanol (478) > methanol (455) > acetone (280) > benzene (252) > diethyl ether (229) > chloroform (220) > methylene chloride (217) > petroleum ether (214). LH

## 80

[Liquid and crystalline glucose. Rules for sampling and test methods.]

Bulgaria, D'rzhaven Komitet za Standartizatsiya  
*Bulgarian Standard* BDS 14879-79, 20pp. (1979) [Bg]

The test methods cover appearance, consistency, flow characteristics, colour, moisture, total ash, HCl-insoluble ash, free mineral acids, reducing substances,  $\text{SO}_2$ , acidity, pH, Fe, caramel, and As, Pb, Zn and Cu salts. HBr





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FAB 20

USE OF GLUCOSE IN FOOD PRODUCTS

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FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

under the direction of:-

Commonwealth Agricultural Bureaux, Farnham Royal, Slough; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublicaties en Landbouwdocumentatie (Pudoc), Wageningen





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Titles of the FABs now available are given on the back cover of this booklet. For up-to-date lists of FABs or suggestions for new topics please write to the address on the back cover. New subjects are searched for at least the five most recent volumes of Food Science and Technology Abstracts. Thereafter each FAB is updated monthly. Copies of each month's abstracts on any topic may be obtained as indicated on the back cover of this publication. At the end of each volume of up-dating, the abstracts are merged and made available as a separate supplement to the original FAB.

Some of the larger FABs have been divided into sections to facilitate use. FAB 47 also has a subject and author index provided.

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Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

EDITOR





1

[Model experiments on the Maillard reaction. V. Structures of some yellow-coloured melanoidins obtained from reaction of *p*-chloroaniline with D-glucose.] Modell-Untersuchungen zur Maillard-Reaktion. V. Aufbau einiger gelb gefärbter Melanoidine aus der Reaktion von *p*-Chloranilin mit D-Glucose. Lessig, U.; Baltes, W.

*Zeitschrift für Lebensmittel-Untersuchung und -Forschung* 172 (6) 466-470 (1981) [10 ref. De, en] [Inst. für Lebensmittelchem. der Tech. Univ. Berlin, Müller-Breslau-Strasse 10, D-1000 Berlin 12]

After reaction of D-glucose with *p*-chloroaniline under the conditions of the Maillard reaction a mixture of instable brown melanoidins was formed which could be stabilized by permethylation. From this mixture 4 defined compounds were isolated, 3 of which represented quinoline derivatives of yellow or red orange colour with mol. wt. in the range of 370-450 dalton. For detn. of their molecular structure, which was carried out by spectroscopic methods, the Curiepoint Pyrolysis was particularly useful. The structures as determined may also be present in melanoidins of higher mol. wt. [See FSTA (1981) 13 11A686 for part IV.] AS

2

[Calculating the amount of HCl required for hydrolysis during manufacture of glucose syrup and glucose.]

Dubinskaya, I. P.; Solov'ev, I. D.

*Sakharnaya Promyshlennost'* No. 11, 45-47 (1980) [6 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

3

[Heating equipment before the evaporating pan stage for glucose manufacture.]

Mikhailenko, A. A.; Gol'dshtein, V. G.; Kovalenok, V. A.

*Sakharnaya Promyshlennost'* No. 3, 47-51 (1981) [7 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

4

[Crystallization of glucose from syrups saccharified by use of enzymes.]

Tregubov, N. N.; Khvorova, L. S.; Tishchenko-Romanchenko, G. V.

*Sakharnaya Promyshlennost'* No. 11, 47-50 (1980) [5 ref. Ru] [MTIPP, USSR]

As syrups produced using enzymic saccharification have a purity of about 98%, it proved possible to develop a crystallization process, in which glucose was obtained in the form of anhydride and the crystallization process was 5-10 × faster than the non-enzymic method. Additionally less expensive equipment was needed and the space requirements were reduced. The overall production costs were less and the quality of the glucose obtained was high. STI

5

[Induction periods during crystallization of glucose from aqueous solutions.]

Gulyuk, N. G.

*Sakharnaya Promyshlennost'* No. 11, 43-44 (1980)

[Ru] [NPO po Krakhmaloproduktam, USSR]

Effects of mixing intensity, temp. and coeff. of supersaturation on duration of induction period of seed formation during crystallization of glucose were determined. The logarithm of the induction period was directly related to that of supersaturation both for glucose and sucrose solutions. This confirmed a similarity between the initial stage of the crystallization process and the kinetics of the chemical reactions involved. STI

6

[Selecting the most favourable working conditions for evaporators in the starch processing industry.]

Kovalenok, V. A.; Mikhailenko, A. A.; Leonova, K. G.; Kiseleva, L. N.

*Sakharnaya Promyshlennost'* No. 11, 39-43 (1980)

[11 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

Thermo-physical characteristics of starch syrups and corn extracts are given as a function of temp. and concn. The data obtained were used to establish optimum thermal conditions for the 1st and 2nd evaporator sections, thereby improving the economics of operation. STI

7

[Thermal stability of glucose syrups during evaporation and boiling.]

Storchevaya, V. V.

*Sakharnaya Promyshlennost'* No. 1, 52-53 (1981)

[3 ref. Ru] [NPO po Krakhmaloproduktam, USSR]

Main causes of colour intensification during condensation of glucose syrups are briefly discussed. When glucose syrups evaporated, their heat stability decreased unless prescribed technological processes were strictly observed. STI

8

[Determination of the polyamines of egg white and their role in the Maillard reaction.] [Thesis;

Determinacao das poliaminas da clara de ovo e sua participacao na reacao Maillard, 55pp., Pt]

Silvestre, M. P. C.

*Informative Anual, Faculdade de Engenharia de Alimentos e Agricola, Universidad Estadual de Campinas* No. 8, 40-42 (1980) [Pt, En]

White of hen's egg was dialysed, freeze-dried and stored with glucose (protein/hexose 3:2 w/w) at 37°C, 68% RH for 0, 5, 10, 20 and 30 days, after which the mixtures were dialysed, freeze-dried, hydrolysed in 6N HCl, and the polyamines were extracted in *n*-butanol and determined by TLC. Three main polyamines were identified: spermidine, spermine and putrescine (27.1, 13.9 and 11.6 µg/g dry albumin, resp., after 0 days, decreasing to 13.7, 8.7 and 6.6 after 5 days and to 3.2, 1.4 and 2.1 after 30 days). Putrescine (free base) showed a higher rate of disappearance when the egg white was stored with glucose compared with loss when stored alone. It was concluded that loss of nutritive value was more a consequence of loss of polyamines than of available lysine. KME



## 9

[Production of glucose/galactose syrup from whey.]  
Johansson, G.  
*Nordisk Mejeriindustri* 8 (6) 329-330 (1981) [Sv]  
[Avdelning för Livsmedelsteknik, Tekniska Högskolan,  
Alnarp, Sweden]

Lactose was hydrolysed experimentally in 1-l column filled with Amberlite ER-151 ion exchange resin, supplying  $H^+$  ions as catalyst. The degree of hydrolysis, estimated by detn. of glucose/galactose by HPLC, approached 100% at low flow rates and at high temp. (100°C). At 80°C there was very little hydrolysis, and at 90°C about 60 min were needed for satisfactory hydrolysis (80%). Degree of hydrolysis was also affected by salt content of the lactose solution, corresponding to various degrees of whey demineralization from 30 to 95%. As a general rule it appeared that 90% demineralization would give reasonable results in practice. In a pilot plant, a glucose/galactose syrup with 60% TS and pH 6.9 was produced by a process involving the following stages: demineralization of whey permeate (after ultrafiltration); 80% hydrolysis of lactose; neutralization with  $OH^-$  ions; decolorization in a column with active carbon; and concentration in a single-effect falling-film evaporator. ADL

## 10

Nontoxic cellulose solvent and process for forming and utilizing the same.  
Tsao, G. T.; Dale, B. E.; Ladisch, M. R. (United States of America, Purdue Research Foundation)  
*United States Patent* 4 265 675 (1981) [En]

A nontoxic cellulose solvent and process for forming and utilizing the same are described. The solvent includes a metal chelating agent, a metal compound, an oxygen-scavenging stabilizing agent and a caustic swelling agent; the solvent is prepared in either aqueous or solid form. The solvent contacts cellulosic materials in order to dissolve cellulose from them. The dissolved cellulose may be reprecipitated and may then be hydrolysed by cellulose enzyme or acid, to yield glucose, with lignin being removed either before or after hydrolysis. AS

## 11

[Use of fructose-containing glucose syrups in gum-type confectionery.] Zur Anwendung fruktosehaltiger Glukosesirupe in gummiartigen Süßwaren.  
Völker, H. H.  
*Zucker- und Süßwarenwirtschaft* 34 (5) 153-156 (1981) [2 ref. De]

Results of 3 series of investigations on the use of fructose-containing glucose syrups in preparation of gelatin gum confectionery are described. Aspects considered include susceptibility of the mix to darkening during heating, processing properties of the mix, organoleptic properties of the products, and moisture uptake and loss during storage. Tables of results are given. It is concluded that high levels of glucose syrup may be used in manufacture of gelatin gums; up to 100% replacement of sucrose may be

possible with high-fructose syrups. Moulding characteristics are improved by use of fructose-containing syrups. The gums made with fructose-containing syrup are more resistant to drying-out than conventional samples; they are, however, more likely to take up water during storage. Little problem with susceptibility of fructose-rich syrups to darkening as a result of heating was observed. AJDW

## 12

[Use of glucose and sorbitol in preparation of dragees.] Das Dragieren mit Dextrose und Sorbit.  
Anon.

*Zucker- und Süßwarenwirtschaft* 34 (6) 205-208 (1981) [2 ref. De]

Use of sorbitol and glucose in manufacture of both hard and soft dragees is discussed, with reference to: basic principles of dragee manufacture; the importance of solution viscosity and the amount of solution applied on the evenness of the coating; drying and crystallization of the coating; solubility curves of glucose, sorbitol, mannitol, sucrose and xylitol; and the necessary panning conditions for coating mixes containing glucose or sorbitol. AJDW

## 13

[Effect of production technology on isosyrup quality.]  
Balazs, F.

*Szeszipar* 29 (1) 10-14 (1981) [Hu] [Szeszipari Vallalat, Szabadegyhaz, Hungary]

Production of high quality isosyrup depends on the use of high purity glucose solution of high glucose content (DE 97-98, (glucose content min. 95%) and the maintenance of optimum parameters during isomerization. These are discussed in detail. ESK

## 14

[Glucose isomerization - enzyme chemistry.]  
Laszlo, E.

*Szeszipar* 29 (1) 8-9 (1981) [Hu] [BME Mezőgazdasági Kémiai Technológia Tanszék, Budapest, Hungary]

The reaction mechanisms and enzyme structures are described for glucose isomerization. They can be used for altering the ratio of fructose production, thereby making the glucose isomerase suitable for the production of high-fructose isosyrups. Reaction kinetic data for various industrially produced immobilized glucose isomerases were compared. ESK

## 15

[Immobilization of glucose isomerase by entrapping in fibrous polymers.]

Kasumi, T.; Tsuji, M.; Tsumura, N.

*Report of the National Food Research Institute [Shokuryo Kenkyusho Kenkyu Hokoku]* No. 37, 109-113 (1980) [6 ref. Ja, en]

The immobilization of glucose isomerase in fibrous polymers was studied. Glucose isomerase extracted from *Streptomyces* sp. 41 was entrapped in 3 kinds of polymers;  $\gamma$ -methyl polyglutamate (PLG), cellulose triacetate (CTA) or cellulose diacetate (CDA). Fibrous immobilized enzymes prepared from PLG or CTA



retained full activity in repeated batchwise reaction. Enzymes prepared with CDA polymer showed considerable loss in activity in repetitive reaction, probably due to the porous non-rigid structure. The diam. of the 3 kinds of enzyme fibres were reduced with decreasing concn. of the carrier material. The activity of immobilized enzyme increased with reduction of the diam. of the fibres. Leakage of enzyme from the fibrous carrier during reaction decreased with increasing polymer concn. AS

## 16

[Derivatographic studies on the Maillard reaction.] Derivatographische Untersuchungen zur Maillard-Reaktion.

Örsi, F.

*Nahrung* 25 (6) 519-529 (1981) [8 ref. De, en, ru] [Dep. of Biochem. & Food Tech., Tech. Univ., Budapest, Hungary]

Derivatography was used to study the Maillard reaction occurring during heat treatment of glucose/lysine mixtures. Individual stages of the reaction were correlated with sections of the derivatograph curve, and changes in the reaction were related to the different compositions tested. The reaction is optimal at a certain glucose/amino acid ratio; optimal mol. ratios were 60:40 for glucose/glycine or methionine, and 70:30 for glucose/glutamic acid, tryptophan or lysine. When glycine or methionine reacts with 1 or 2 molecules of glucose (1.5 molecules on average) they only have 1 functional group, whereas tryptophan, lysine and glutamic acid have several functional groups. For lysine the 2 groups are of virtually equal strength and thus the 2 stages of reaction are not separated; in contrast the less basic ring of tryptophan only reacts at elevated temp. The 2nd functional group of glutamic acid may be the carboxyl group, as in the reaction of carboxylic acids with sugars. IN

## 17

[Crystalline dextrose.]

Taiwan, National Bureau of Standards

*Chinese National Standard* CNS N5153, 1p. (1979)

[Ch]

## 18

Water sorption isotherms of sucrose and glucose by inverse gas chromatography.

Smith, D. S.; Mannheim, C. H.; Gilbert, S. G.

*Journal of Food Science* 46 (4) 1051-1053 (1981) [14 ref. En] [Food Sci. Dep., Cook Coll., Rutgers Univ., PO Box 231, New Brunswick, New Jersey 08903, USA]

A novel inverse gas chromatographic procedure involving a Beckman GC-5 dual column gas chromatograph with a thermal conductivity detector, He as the carrier gas and temp. of 40-75°C, was used to obtain the water sorption isotherms of sucrose and glucose. The method allows calculation of partial pressure of water and water uptake directly from a chromatogram. The isotherms developed are in a water activity range well below that of conventionally developed isotherms. IFT

## 19

[Comminution of non-chocolate masses with 5-roll mills as pre- and fine-milling units.] Zerkleinerung von Nicht-Schokoladenmassen mit Fünfwalzwerken als Vor- und Feinwalzen.

Anon.

*Kakao und Zucker* 33 (6) 174-176 (1981) [De]

Use of 5-roll mills for grinding of non-chocolate masses (e.g. glazes, cremes, spreads) is discussed, with reference to: experience with grinding of chocolate masses; basic principles of grinding of suspensions; 2-stage grinding; requirements concerning the composition and characteristics of the mix to be ground; equipment required; practical aspects; and advantages of the 2-stage grinding procedure. A]DW

## 20

Process for isomerizing glucose to fructose.

Barrett, S. P.; Nelson, W. J. (Standard Brands Inc.)

*United States Patent* 4 288 548 (1981) [En]

Process is described for enzymically isomerizing glucose to fructose in an ion exchange refined, glucose-containing liquor. The liquor is treated with an ion exchange material in the bisulphite/sulphite form and then contacted with immobilized glucose isomerase under isomerizing conditions. RAW

## 21

Chemical changes in casein heated with and without D-glucose in the powdered state or in an aqueous solution.

Kato, H.; Matsumura, M.; Hayase, F.

*Food Chemistry* 7 (3) 159-168 (1981) [16 ref. En] [Dep. of Agric. Chem., Univ. of Tokyo, Bunkyo-ku, Tokyo, Japan]

Chemical changes in casein, heated either in the presence or the absence of D-glucose at 50° or 75°C in a powdered state at 75% RH or in an aqueous solution were investigated. During heating, colour development, the formation of polymerized products and severe decomposition of amino acid residues occurred. In the powder reaction system, mainly basic amino acids decomposed, whereas in the solution systems, all amino acids were uniformly decomposed. In addition, small amounts of free amino acids and low mol. wt. peptides (< 500) were detected. These amounts were greater in the solution system, suggesting that non-enzymic cleavage of peptide bonds occurred. These changes were observed both in the absence and in the presence of glucose, but glucose promoted such changes. AS

## 22

High methoxyl pectins and their uses in jam manufacture - a literature survey. [Review]

Ahmed, G. E.

*Scientific and Technical Surveys, Leatherhead Food RA* No. 127, 16pp. (1981) [40 ref. En, fr, de] Price Members £1.50 Non-members £3.00 [Leatherhead Food RA, Randalls Rd., Leatherhead, Surrey, UK]

This survey reviews the definitions and nomenclature of different forms of pectic substances and their natural occurrence. It then reviews published work on: General properties of pectin (structure, gelation, and rheological properties of pectin gels) (pp. 2-6); Setting times and setting temp. of pectin gels (factors affecting setting



temp. and setting time, setting temp. and gel strength, and detn. of setting time) (pp. 6-9); Uses of pectin in preserves (pp. 9-10); Glucose syrups in jams and jellies (properties of glucose syrup, uses of glucose syrup in jams and jellies) (pp. 10-13); and Syneresis of pectin jellies (pp. 13-14). VJG

## 23

[Exploring new sources of sugar – the rapid development of fructose production.]

Chang, L. T.

*Food Science and Technology, China* No. 7, 8 (1981)

[Ch][Beijing Food Sci. Res. Unit, PB 399, Peking, China]

Fructose is the best sweetener. By using enzymes, it is easy to transform glucose to fructose. Many starch-rich plants, e.g. corn, sorghum, sweet potato, potato, cassava, can be good raw materials for fructose-glucose syrup production. Because of high content of starch, high price of co-products and ease of transport and storage, corn is the ideal raw material among them. GK

## 24

[Glucose composition and method for its production.]

Traubenzuckermischung und Verfahren zu ihrer Herstellung.

Wixforth, B. (Biolabor Walter Brachmann)

*German Federal Republic Patent Application*

2 947 186 (1981)[De]

A sweet composition for anti-caries fluoride treatment comprises glucose and ground, dried calcareous algae (Corallinaceae) particularly *Lithothamnion*. The mixture is prepared by adding powdered dried algae to the glucose raw material: *Lithothamnion* contains (by wt.) 77.2%  $\text{CaCO}_3$ , 8%  $\text{MgCO}_3$ , 1.62%  $\text{NaCl}$ , 0.93%  $\text{F}^-$  and 1.7% protein. The composition can be consumed as sweets by children of teething age. W&Co

## 25

Process for treating cellulosic materials and obtaining glucose therefrom.

Tsao, G. T.; Ladisch, M. R.; Ladisch, C. M.; Hsu, T.-A. (United States of America, Purdue Research Foundation)

*United States Patent* 4 281 063 (1981)[En]

Process is described for treating cellulosic materials to give glucose: it includes initial acid or base treatment of the cellulosic materials to remove hemicellulose, followed by a solvent treatment of the solid residue to dissolve the native cellulose contained in it. The dissolved cellulose is separated from the solid lignin-containing residue, and reprecipitated by contacting with water. The reprecipitated cellulose is hydrolysed to glucose either by acid or enzyme hydrolysis. If desired, the cellulose may be reprecipitated and hydrolysed in the presence of the lignin-containing solid, the latter being separated from the glucose. AS

## 26

Study of glucose massecuite mixing.

Bohacenko, I.; Fort, I.

*Sbornik Vysoke Skoly Chemicko-Technologicke v Praze, E* No. 50, 245-265 (1979) [7 ref. En, cs, ru]

[Development Dep. of Starch Factories, Inst. of Chem. Tech., Prague, Czechoslovakia]

The mixing of crystalline glucose in its mother syrup was studied in a mechanically stirred laboratory crystallizer with 3 low-speed impellers of spiral and ribbon shapes, with different revolution speeds and for various concn. of glucose massecuites. Mathematical calculations are presented (in dimensionless form) for obtaining uniform dispersion of crystalline glucose under the various conditions, including the most suitable types of impeller. ELC

## 27

[Continuous throughput dissolver for producing a sugar solution.] Durchflussslöseanlage zum Herstellen einer Zuckerlösung.

Beckers, H.; Bonus, H. (Robert Bosch GmbH)

*German Federal Republic Patent Application*

2 933 053 (1981)[De]

A continuous throughput dissolver installation is described, for the production of sugar solution from a sugar/glucose/water mixture. The installation conduit contains an externally heated coiled pipe through which the mixture is pumped under pressure. This coiled pipe contains a number of spiral shaped mixing elements which accelerate dissolution of the sugar in the small quantity of water present. AS

## 28

[Studies on the Maillard reaction. II. Reaction of glucose with phenylalanine in water.] Untersuchungen zur Maillard-Reaktion. II. Zur Reaktion von Glucose mit Phenylalanin in Wasser.

Westphal, G.; Cieslik, E.

*Nahrung* 25 (8) 749-757 (1981) [81 ref. De, en, ru]

[Sektion Nahrungsgüterwirtschaft & Lebensmitteltech., Humboldt-Univ., Berlin]

The Maillard reaction was studied in a glucose/phenylalanine system in boiling water. Extinction at 430 nm shows an induction phase (up to 15 h), and a steady-state phase (15-45 h), followed by a decreasing phase. The graph of the non-enzymic browning is indicative of a consequent reaction. The graph also shows 2 minima for glucose concn. (at 0 and 70 min) during the induction phase; the 1st minimum results from the method, and the 2nd can be explained by reaction of a further glucose molecule, giving bis-glucosyl-phenylalanine; this reaction is pH dependent (optimum pH 5.2). Phenylalanine concn. is also minimum at 70 minutes. [See FSTA (1982) 14 3A210 for part I.] IN



## 29

[Studies on the Maillard reaction. III. Gas chromatographic-mass spectrometric study of the non-volatile reaction products of glucose with thiourea.] Untersuchungen zur Maillard-Reaktion. III. Gaschromatographisch-massenspektrometrische Untersuchung nichtflüchtiger Produkte der Reaktion zwischen Glucose und Thioharnstoff. Westphal, G.; Kroh, L.; Sandner, E. *Nahrung* 25 (10) 893-903 (1981) [12 ref. De, en, ru] [Sektion Nahrungsgüterwirtschaft & Lebensmitteltech., Humboldt-Univ., Berlin]

Gas chromatography-MS was used to study the non-volatile products resulting from the reaction of glucose with thiourea. The main components were glucosyl thiourea (previously reported by the authors), furan compounds and substituted formamidine disulphide. 7 of the 10 GLC peaks could be identified by MS. MS fragmentation of these products is discussed. [See preceding abstr. for part II.] IN

## 30

[Studies on non-enzymic browning reaction in liquid model systems.] Untersuchungen zur Nicht-enzymatischen Bräunungsreaktion in flüssigen Modellsystemen.

Resnik, S. L.; Plett, E. A.; Loncin, M. *Zeitschrift für Lebensmittel-Technologie und -Verfahrenstechnik* 32 (5) 213-216 (1981) [14 ref. De] [Inst. für Lebensmittelverfahrenstechn., Univ. Karlsruhe, Kaiserstrasse 12, 7500 Karlsruhe 1, Federal Republic of Germany]

Studies were conducted on non-enzymic browning in glucose/alanine solutions, each of these 2 constituents being present at a concn. of 0.04 mol/l. Effects of  $a_w$  (0.41-0.87), water-binding agent (ethylene glycol, LiCl, MgCl<sub>2</sub>) and pH (4.5-7.0) were evaluated. Extent of browning was evaluated by means of a Hunter Lab D2SA-3 colour measurement meter and a Beckmann 5230 spectrophotometer. Graphs of results are given. The results show that non-enzymic browning in this model system increased with decreasing  $a_w$ ; this effect may be obscured by pH differences. Spectral data showed that the same reaction products were formed in all cases. The relative merits of the two instruments for evaluation of browning were studied; the spectrophotometer was more sensitive, but slower. AJDW

## 31

[Application of thin layer chromatography to qualitative and quantitative determination of glucose, fructose and sucrose in potato juice.]

Kubiak, A.; Foremska, E. *Roczniki Akademii Rolniczej w Poznaniu* No. 108 (Fizyka, Chemia 2) 55-67 (1978) [16 ref. Pl, en, ru] [Inst. Fizyki & Chemii, AR, Poznan, Poland]

In this extensive study, the value of several adsorbents and solvent systems was tested in model experiments and in experiments with Urban potato cv. juice to establish best conditions for TLC qualitative and quantitative determination of glucose, fructose and sucrose. All procedures are fully described; and the

results of numerous test variants are tabulated and graphically presented, and chromatograms are shown. Best resolutions and quantitative determinations were obtained using a mixture (87:13) of silica gel (Kieselgel-G, E. Merck) with gypsum, 2-dimensional chromatography using 1-propanol/water (85:15) and 1-butanol/glacial acetic acid/diethyl ether/water (90:60:30:10), and aniline with phosphoric acid as visualizer. The method of Purdy & Trotter [*Analyst* (1962) 87, 802] was found suitable only for qualitative evaluation of the sugars studied. [See following abstr.] SKK

## 32

[Silica gel separation of mixture of glucose, fructose and sucrose in potato juice.]

Kubiak, A.; Stachowiak, J. *Roczniki Akademii Rolniczej w Poznaniu* No. 108 (Fizyka, Chemia 2) 69-80 (1978) [11 ref. Pl, en, ru] [Inst. Fizyki & Chemii, AR, Poznan, Poland]

The experiments described in this paper were similar in scope, design, execution and presentation to those summarized in the preceding abstr. The conclusions on best conditions for separation and quantitative determination of the 3 sugars were also similar, except that 1-dimensional TLC using the 2 solvent systems stated there was found the most satisfactory. SKK

## 33

Method for the production of powdered dextrose.

Mise, Y.; Tomimura, E. (CPC International Inc.)

*United States Patent* 4 297 146 (1981) [En]

Method is described for the production of an anhydrous powdered dextrose containing large amounts of anhydrous crystals of  $\beta$ -form dextrose. It involves concentrating aqueous solutions of dextrose, or aqueous solutions containing dextrose up to a sugar concn. 90-98%; adding anhydrous crystals of  $\beta$ -dextrose or powdered dextrose containing large amounts of anhydrous  $\beta$ -dextrose as seed crystals to this concentrate at  $> 60^\circ\text{C}$ ; maintaining the temp.  $> 60^\circ\text{C}$ , and while stirring gently, eliminating the free water by vacuum dehydration from the time of formation of microcrystals by pressure reduction. AS

## 34

The production and properties of glucose syrups. III. Sweetness of glucose syrups and related carbohydrates.

Kearsley, M. W.; Dziedzic, S. Z.; Birch, G. G.; Smith, P. D.

*Stärke* 32 (7) 244-247 (1980) [21 ref. En, de] [Nat. Coll. of Food Tech., St. George's Avenue, Weybridge, Surrey UT 130DE, UK]

A series of glucose syrups, DE 21, 32, 46, 65 and 100% (D-glucose), were assessed for sweetness before and after hydrogenation at concn. of 10% and 20%. Results (tabulated) showed significant increases in sweetness for all except 21% DE glucose syrups and D-glucose at 10%, and for all except D-glucose at 20% concn. These results contradict a previous report [see FSTA (1977) 9



7A443]. Hydrogenation of mono- and disaccharides except D-glucose and cellobiose resulted in increased sweetness. Various theories are advanced to explain the results: intra- or intermolecular H-bonding or presence of maltitol in glucose syrups in the mid-DE range. [See FSTA (1981) 13 6L415 for part II.] RM

### 35

[Energy conservation in the 'Szabadegyhaz' isosugar factory.]

Rutkovszky, J.

*Szeszpar* 29 (4) 161-162 (1981) [Hu] [Szabadegyhazai Szeszpari Vallalat, Szabadegyhaza, Hungary]

In the factory complex described, 'isosugar' syrup is produced enzymically from maize. The complexity of the heat consuming equipment, e.g. large capacity condensers, large number of heat exchangers, rectifying and distilling columns, direct and indirect driers, etc., require strict co-ordination of the available energy supply. The presently used energy consumption and its production and the conversion system is described. ESK

### 36

[Analysis of starch hydrolysates.] Beitrag zur Analytik von Stärkehydrolysaten.

Schweizer, T. F.; Reimann, S.

*Zeitschrift für Lebensmittel-Untersuchung und -Forschung* 174 (1) 23-28 (1982) [25 ref. De, en] [Dep. de Recherche, Soc. d'Assistance Tech. pour Produits Nestle SA, CH-1814 La Tour-de-Peilz, Switzerland]

Carbohydrate composition of 3 maltodextrins and 2 glucose syrups of DE between 4 and 59 was investigated. The mol. wt. distributions were determined by gel-chromatography on Sephadex G 50 and Sepharose 6 B, the malto-oligosaccharides by quantitative high-performance TLC on silica gel. Solubility of starch hydrolysates in several aqueous alcohols was correlated with their mol. wt., distribution and the polarity of the solvents. On the basis of measurements of iodine affinities of high-mol. wt. fractions, 40% ethanol (v/v) is proposed as extractant for separating starch and dextrins in foodstuffs. AS

### 37

[Glucose oxidase - characteristics and possible applications in the food industry.] Glukoseoxydase - Eigenschaften und Einsatzmöglichkeiten in der Lebensmittelindustrie.

Kirstein, D.; Kühn, W.

*Lebensmittelindustrie* 28 (5) 205-208 (1981) [83 ref. De, en, ru, fr] [Zentralinst. für Molekularbiol., Berlin-Buch]

After a brief description of preparation, characteristics and immobilization of glucose oxidase, the 4 main applications in the food industry are described. These are: addition of soluble enzyme to the product (for elimination of glucose or O<sub>2</sub>); use of immobilized enzyme in through-flow reactors (e.g. elimination of O<sub>2</sub> from fruit juices); impregnation of the inner face of packaging materials (to protect the surface of moist foods against oxidation); and addition of the enzyme preparation, together with buffers, glucose, catalase and, if required, sterilizing agents, in sealed plastics bags (e.g. for elimination of O<sub>2</sub> from the headspace of dry products, or for control of corrosion). IN

### 38

[Production and immobilization of glucose isomerase on collagen.] [Review]

Krakowiak, A.

*Przemysł Spożywczy* 35 (5/6) 172-176, 220 (1981) [23 ref. Pol, fr, de, ru, en]

### 39

Effect of solutes on rheology of soy flour and its components.

Urbanski, G. E.; Wei, L. S.; Nelson, A. I.; Steinberg, M. P. *Journal of Food Science* 47 (3) 792-795, 799 (1982) [En] [Dep. of Food Sci., Univ. of Illinois, Urbana, Illinois 61801, USA]

The objective was to investigate the effects of solutes on rheology of soybean beverage components. Mixtures of these components with water and various amounts of sucrose were subject to shear stress-shear rate analysis, and both apparent viscosities and power law parameters were determined. Sucrose addition decreased "a values" (apparent viscosity) and increased "b values" (degree of Newtonian behaviour) of all component suspensions. The "a values" showed a min. at sucrose concn. of 55-60% of the aqueous phase. Glucose behaved like sucrose. On a wt. basis, NaCl reduced "a values" and increased "b values" to a greater extent than either sucrose or glucose. In general, addition of solutes reduced the high viscosity of conc. soy beverages. IFT

### 40

Some properties of whole-cell glucose isomerase immobilized in polyacrylamide gel by radiation.

Bachman, S.; Gebicka, L.; Gasyńska, Z.

*Starch/Stärke* 33 (11) 366-369 (1981) [21 ref. En, de] [Inst. of Applied Radiation Chem., Tech. Univ. of Lodz, Wroblewskiego 15, 93-590 Lodz, Poland]

Whole-cell glucose isomerase was immobilized by the method of block polymerization of acrylamide initiated by <sup>60</sup>Co irradiation. Some properties of immobilized glucose isomerase were studied under various reaction conditions, in respect of its use as industrial catalyst. It was established that Co<sup>2+</sup> ions did not increase stability of the immobilized enzyme at pH > 8.0. The half-life of the immobilized glucose isomerase was found to be 24 days at 60°C, and fell rapidly at higher temp. AS

### 41

[Investigations of the reactions in photochemical oxidation of D-glucose to D-gluconic acid.]

Reaktionstechnische Untersuchungen zur fotomechanischen Oxidation von D-Glucose zu D-Gluconsäure.

Degelmann, H.-P.; Emig, G.; Hofmann, H.

*Zuckerindustrie* 107 (2) 117-125 (1982) [35 ref. De, en, fr, es] [Inst. für Tech. Chem., Univ. Erlangen-Nürnberg, 8520 Erlangen, Federal Republic of Germany]

Glucose solutions, through which oxygen or nitrogen had been streamed, were irradiated in an immersed-lamp photoreactor with a high-pressure mercury lamp. In different tests, H<sub>2</sub>O<sub>2</sub>, HCl or NaOH were added alone or in combination. Different wavelength sections of the irradiated UV energy were filtered out using glass filters. The aim was to establish if and under what conditions photo-oxidation of glucose to gluconic acid is generally possible. Lactic, oxalic and acetic acids were identified by HPLC as additional oxidation products.



The assumption that addition of  $H_2O_2$  is necessary to initiate the photochemical reaction was found to be false; irradiation evidently does not initiate selective splitting-off of the H radical in glucose. AS

## 42

[Purification of starch hydrolysates by electro-filtration.]

Bazhal, I. G.; Kupchik, M. P.; Vorona, L. G.; Bondar', E. G.; Pastushkho, V. N.; Shornikova, A. N. *Sakharnaya Promyshlennost'* No. 9, 52-54 (1981) [7 ref. Ru] [Inst. Tekh. Teplofiziki AN, USSR]

Experimental equipment used for electro-filtration of glucose syrups which achieves separation of various foreign substances e.g. microorganisms, proteins and other macromolecular compounds, further colouring matters, colloids etc. is described. The syrups pass through a layer of granulated material, under the action of direct electrical current. The undesirable particles are coagulated and trapped on the granules. Results are presented showing the relation to tension, through-flow rate etc. STI

## 43

Treatment of the effluent of a glucose production plant using a rotating biological packed bed.

Mehdi Borghei, S.

*Process Biochemistry* 16 (2) 29-30, 32-34 (1981) [13 ref. En] [Biochem. & Bioenvironmental Res. Cent., Tehran Univ. of Tech., PO Box 2654 Tehran, Iran]

Use of a 3-stage rotating biological packed bed (RBPB) for treatment of starch-glucose wastes was evaluated. The efficiency of organic material removal was determined at various loadings and speeds of rotation. With loading rates of 9.5 kg BOD/m<sup>3</sup>/day, average BOD removal was 72% and total organic C (TOC) removal was 68%. Loading rates of 2.5 kg BOD/m<sup>3</sup>/day gave average BOD removal of 92% and TOC removal of 88%. The sludge produced in the RBPB had good settling properties, and final effluent was non-odorous, well oxidized and could be used for irrigation water. SP

## 44

[Use of surface condensers for production of glucose syrups from starch.]

Vinokurov, V. N.; Veksler, N. P.; Gorbatov, V. M.; Solov'ev, I. D.

*Sakharnaya Promyshlennost'* No. 10, 47-50 (1981) [4 ref. Ru] [Yaroslavskii Krakhmalo-patochnyi Kombinat, Yaroslavl, USSR]

Advantages of surface condensers are discussed in comparison with mixing condensers. Most suitable surfaces for surface condensers for the purpose of starch manufacturing plants are recommended on the bases of investigations performed. Examples of automation of this equipment are presented. STI

## 45

[Determination of the contents of juice and sugars in grapes.]

Arkhipovich, N. A.; Evfits, T. Ya.

*Vinodelie i Vinogradarstvo SSSR* No. 5, 54-55 (1981) [Ru] [Kievskii Inst. Pishchevoi Promyshlennosti, Kiev, USSR]

The juice content was determined indirectly from the refractometric detn. of DM in the juice of crushed grapes before and after dilution. For detn. of glucose and fructose, the only sugars contained in grape juice, a polarometric method was developed for use with mixtures of sugars and grape juice. For detn. of sugars in the juice of red grapes, prior precipitation of colorants and optically active substances, preferably by the use of lead acetate, was necessary. STI

## 46

Production and physico-chemical properties of isomerized glucose syrups. I. Sweetness.

Dziedzic, S. Z.

*Starch/Stärke* 33 (11) 369-372 (1981) [24 ref. En, de] [Dep. of Food Sci., Univ. of Reading, London Road, Reading, UK]

Glucose syrups of 21, 45, 65 and 100% DE were isomerized using a Novo Sweetzyme isomerase over 24 h. The reaction was followed by HPLC. Syrups with 49-52% isomerized glucose syrups were obtained. The sweetness of the glucose syrups was determined before and after isomerization in terms of threshold, and relative sweetness to a 5% sucrose standard solution at varying concn. Significant increases (up to two-fold) were shown for both high and low DE syrups upon isomerization. AS

## 47

Gas-liquid chromatographic determination of fructose, glucose and sucrose in cane sugar products.

Wong Sak Hoi, Y. L.

*International Sugar Journal* 84 (999) 68-72 (1982) [14 ref. En, fr, de, es] [Mauritius Sugar Industry Res. Inst., Reduit, Mauritius]

GLC method for simultaneous detn. of fructose, glucose and sucrose in cane juice and cane molasses is described. The sugars are converted to their oximes before being trimethylsilylated, with the result that glucose is presented as a single peak on the chromatogram; equilibrium attainment of the sample solution is therefore unnecessary. Comparisons were made with the Lane & Eynon method for reducing sugars and the Jackson & Gillis No. IV double-polarization method for sucrose detn. Accuracy and precision of the method were found to be good. AS

## 48

Saccharification of starch hydrolysates.

Norman, B. E. (Novo Industri A/S)

*UK Patent Application* 2 074 167A (1981) [En]

Process is described in which starch hydrolysates are saccharified to high DE glucose syrups using a combination of glucoamylase and isoamylase. IFT



49

[Sugars in green olives. I. Enzymatic determination of glucose.]

Fernandez Diez, M.; Fernandez-Bolanos, J.; Heredia Moreno, A.; Rivas Moreno, M.; Iglesias Guerra, F. *Grasas y Aceites* 32 (2) 83-85 (1981) [11 ref. Es, en, fr] [Inst. de la Grasa y sus Derivados, Seville, Spain]

A method is described for quantitative detn. of glucose in green olive pulp by glucose oxidase. This allowed detn. of 1.6-3.5% glucose in olive pulp from var. Gordal and Manzanilla without prior separation. RM

50

[High performance liquid chromatographic determination of saccharides in dairy products.]

Yasui, T.; Furukawa, T.; Hase, S.

*Journal of Japanese Society of Food Science and Technology [Nippon Shokuhin Kogyo Gakkaishi]* 27 (7) 358-362 (1980) [5 ref. Ja, en] [Nat. Food Res. Inst., 2-1-2 Kan'nondai, Yatabe-machi, Tsukuba-gun, Ibaraki, 305 Japan]

Using a Lichrosorb NH<sub>2</sub> (10  $\mu$ m) column, fructose, glucose, lactose and sucrose were separated and determined in samples of liquid milk, milk coffee, cream, yoghurt, ice cream, dried skim milk and sweetened condensed whole milk. The analysis time was <10 min, and average recovery of lactose added to samples was 102.3%. The precision was such that for sugar contents of >1%, the coeff. of variation was 4.5%. [From En summ.] JRR

51

[An improved automated method for the measurement of D-glucose in soy sauce and its application to the control of fermentation.]

Kanbe, C.; Ushijima, S.; Uchida, K.

*Journal of Japanese Society of Food Science and Technology [Nippon Shokuhin Kogyo Gakkaishi]* 28 (10) 528-533 (1981) [12 ref. Ja, en] [Cent. Res. Lab., Kikkoman Corp., Noda-shi, Chiba-ken, 278 Japan]

An improved enzymic method using 4-aminoantipyrine and *p*-hydroxybenzoic acid for the detn. of D-glucose in soy sauce is described. The reagent 4-aminoantipyrine is not carcinogenic, unlike the reagent *o*-dianisidine formerly used. In the procedure, D-glucose is oxidized by glucose oxidase to D-gluconic acid with the simultaneous production of hydrogen peroxide, which oxidatively couples with 4-aminoantipyrine and *p*-hydroxybenzoic acid in the presence of peroxidase to yield a quinoneimine dye with max. absorption at 500 nm. The method requires no specific pretreatment of samples other than simple dilution. The calibration curve is linear to 100 mg/dl. Many substances that may be encountered in soy sauce do not interfere with the quantitative reaction. An efficient automatic assay method was established by the use of this procedure with a new discrete-type auto-analyzer. In addition, the behaviour of various neutral sugars in the soy sauce brewing process was traced using by ion-exchange liquid chromatography. A

distinct decrease of glucose appeared at the same time when brewing microorganisms (*Pediococcus halophilus*, *Saccharomyces rouxii*, *Torulopsis*) grew actively, though the changes of the other sugars were not so prominent. These results suggest that the determination of glucose, not of reducing sugars, has a more practical meaning in the control of fermentation during the process of soy sauce brewing. AS

52

[Volatile compounds formed on roasting L-theanine with D-glucose.]

Hara, T.

*Journal of the Agricultural Chemical Society of Japan [Nihon Nogei Kagakkai-shi]* 55 (11) 1069-1072 (1981) [10 ref. Ja, en] [Nat. Res. Inst. of Tea, Kanaya, Haibara, Shizuoka 428, Japan]

A mixture of L-theanine ( $\gamma$ -glutamylethylamide) and D-glucose was roasted at 150-160°C for about 1 h. From the condensate of volatile components, the main product (1-ethyl-3,4-dehydropyrrolidone), 5 pyrroles, 3 alkyl pyrazines and 4 furans were identified by spectroscopic methods (MS and NMR) and gas chromatography. A pathway for the formation of the main product from L-theanine is proposed. AS

53

Kinetic behavior of free radical formation in the nonenzymatic browning reaction.

Milic, B. L. J.; Piletic, M. V.; Grujic-Injac, B.; Cembic, S. M.

*Journal of Food Processing and Preservation* 4 (1/2) 13-26 (1980) [14 ref. En] [Organic Chem. Dep., Fac. of Tech., Novi Sad Univ., 21000 Novi Sad, Yugoslavia]

The present study was undertaken in order to define

kinetics of the initial stage of nonenzymic browning reaction in model systems of D(+)-glucose and isomers of aminobutyric acids. The kinetics of free radical formation at the initial stage of nonenzymic browning reaction in examined model systems were determined using electron paramagnetic resonance. Approx. rate constants, Arrhenius activation energies and overall rate expressions are also discussed. It is concluded that formed free radicals were responsible for the pyrazine formation at the initial stage of nonenzymic browning reaction, when the reaction between aldoses and amino acids was performed in alkaline water solutions. AS

54

[Process for the manufacture of a porous enzyme-polystyrene-complex.] Verfahren zur Herstellung poröser Enzym-Polystyrol-Komplexe.

Schellenberger, A.; Fischer, J.; Häupke, K.; Schwachula, G. (German Democratic Republic, Institut für Enzymologie & Technische Mikrobiologie) *German Democratic Republic Patent* 149 679 (1981) [De]

A process is described for the production of a porous, high-activity enzyme-polystyrene complex for utilization in the food industry, etc. The copolymers produced are particularly suitable for binding glucoamylase, and may be used in enzymic hydrolysis of starch in the manufacture of high-quality glucose. IN



## 55

**Maillard browning reaction of sugar-glycine model systems: changes in sugar concentration, color and appearance.**

Reyes, F. G. R.; Poocharoen, B.; Wrolstad, R. E. *Journal of Food Science* 47 (4) 1376-1377 (1982) [En] [Dep. of Food Sci. & Tech., Oregon State Univ., Corvallis, Oregon 97331, USA]

The reactivities of glucose, fructose, and sucrose with glycine (1:1 molar ratio) at 60°C and pH 3.5, were compared over 280 h. While fructose initially browned at a faster rate, it was overtaken by glucose after 80 h. Initially more fructose than glucose was consumed, but the reverse was true after 60 h. Sucrose was readily hydrolysed under these reaction conditions and underwent Maillard browning reactions, its colour and appearance being similar to the glucose solutions at the later stages of the experiment. Glucose and sucrose solutions developed considerable haze while the fructose-glycine solution remained clear. IFT

## 56

**[Studies on the free sugars of green tea. I. High performance liquid chromatographic determination of free sugars in green tea.]**

Anan, T.; Takayanagi, H.; Ikegaya, K.; Nakagawa, M. *Journal of Japanese Society of Food Science and Technology [Nippon Shokuhin Kogyo Gakkaishi]* 28 (12) 632-639 (1981) [15 ref. Ja, en] [Nat. Res. Inst. of Tea, 2769 Kanaya-cho, Haibara-gun, Shizuoka-ken, 428 Japan]

HPLC method for detn. of free sugars (glucose, fructose, sucrose, raffinose and stachyose) in green tea was devised. A column packed with Shodex Ionpak S-801 was run at 60°C, with water as the mobile phase, and a flow rate of 0.5 ml/min. Xylitol was used as an internal standard, and the detection was by refractive index changes. Coeff. of variance for the method ranged from 1.8 to 11.51%, and recoveries were 99.2-102.1%. [From En summ.] JRR

## 57

**Diffusion hindrance in isoglucose production with immobilized enzymes.**

Hollo, J.; Laszlo, E.; Hoschke, A. *Starch/Stärke* 33 (11) 361-366 (1981) [18 ref. En, de] [Univ. of Tech. Sci., Inst. of Agric. Chem. Tech., H-1521 Budapest, Hungary]

The kinetics of diffusion hindrance has been determined for glucose-isomerase enzymes immobilized in different ways (on the surface, enclosed in the gel or by copolymerization). Mass transfer constants, actual surface substrate concentrations, etc. were solved graphically. Based on the results obtained, optimum operation conditions of the bioreactor were determined. AS

## 58

**The periodic isomerization of glucose in starch hydrolysates, using a soluble and insoluble preparation of glucose isomerase.**

Boruch, M.; Nebesny, E. *Acta Alimentaria Polonica* 6 (4) 215-226 (1980) [12 ref. En, pl] [Dep. of Chem. Food Tech., Tech. Univ., Lodz, Poland]

The aim of the studies reported in this paper was to obtain fructose from relatively cheap substrates ('hydrol', produced by potato starch hydrolysis) by the action of glucose isomerase (GI). Both single-use soluble GI (Optisweet P) and repeated-use insoluble GI (Sweetzyme A) were utilized, the latter being applied to 14 consecutive batches of each substrate. The substrates used were: (i) raw hydrol containing residues of wash syrup, DE 75; (ii) hydrol purified by ion exchange, DE 76; (iii) hydrol purified by ion exchange and saccharified with glucoamylase, DE 83; (iv) hydrol containing no added wash syrup, DE 68; (v) dense glucose solution, DE 84; (vi) solution of confectionery syrup, DE 40.1; and (vii) crystalline glucose, DE 99.9. Since Ca inhibits enzymic isomerization it was eliminated, together with other ions, from all the substrates. Details of the isomerization procedures are included and the results are detailed in tables. The degree of isomerization obtainable with both GI was >40% for all substrates except (i), where the degree of isomerization was 32.5%. In the case of repeated-use GI, >40% isomerization was obtained in ≤7 consecutive batches but thereafter the degree of isomerization decreased to <40%. JA

## 59

**Effect of fermentation on lactose, glucose, and galactose content in milk and suitability of fermented milk products for lactose intolerant individuals.**

Alm, L. *Journal of Dairy Science* 65 (3) 346-352 (1982) [40 ref. En] [Mjölkcentralen Arla, S-105 46 Stockholm, Sweden]

Contents of lactose, glucose and galactose were measured in Swedish milk and fermented milk products. During the preparation of buttermilk, kefir and ropy milk (langmjölk, fermented with *Streptococcus lactis* subsp. *longi* and *Leuconostoc cremoris*) there was a 20-30% decrease in lactose content; more marked decreases were observed with yoghurt, acidophilus milk and bifidus milk (from 5.0 g/100 g non-fermented milk to 2.4-2.6 g/100 g fermented products). Consumption of 500 ml low-fat milk by 8 lactose-intolerant individuals resulted in abdominal pain and diarrhoea. When the same individuals consumed 500 ml yoghurt or acidophilus milk, these symptoms did not occur. Results indicate that fermented milk products can be used in diets for lactose-intolerant subjects. MEG

## 60

**Newly approved bulking agent replaces higher calorie ingredients.**

Anon.

*Food Development* 15 (7) 38-39 (1981) [En]

Consideration is given to the development by Pfizer, Inc., of polydextrose, a 1-calorie/g non-sweet bulking agent capable of replacing higher calorie ingredients



such as sugars, carbohydrates and fats in some food products. The FDA has approved polydextrose for use in frozen dairy desserts and mixes; gelatins, puddings and fillings; baked goods and baking mixes; confections and frostings; chewing gum; salad dressings; and hard and soft candy. Polydextrose is available in 2 forms: an amorphous powder, and a 70% solution of polydextrose partially neutralized with KOH. VJG

## 61

[Utilization of isosyrup in syrup production.]

Hoffer, F.

*Szeszipar* 29 (1) 24 (1981) [Hu] [Szörpfeldolgozó Szövetkezeti Vállalat, Szob, Hungary]

Identical blackberry-, lemon-, orange- and Jaffa orange-flavoured syrups, made both with isoglucose and sucrose and diluted to 12% (refractometer) with carbonated water were compared after 3 months storage either at room temp. exposed to light or under refrigeration. The drinks obtained from sucrose syrup were sweeter than those obtained from isoglucose syrup. With the exception of the Jaffa drinks the samples made with isoglucose had a flatter taste and flavour. ESK

## 62

[Influence of SO<sub>2</sub> and glucose on total polyphenol assay by the Folin-Ciocalteu reagent.]

Iino, S.; Furuya, T.; Watanabe, M.

*Report of the Institute for Wine and Food Research, Yamanashi Prefecture [Yamanashi-ken Shokuhin Kogyo Shidosho Kenkyu Hokoku]* 13, 47-49 (1981) [8 ref. Ja]

The addition of Na<sub>2</sub>SO<sub>3</sub> (SO<sub>2</sub> equivalent 40 mg/l) to a solution of tannic acid at 25 mg/l resulted in a 72% overestimation of phenolics by the Folin-Ciocalteu method; the addition of SO<sub>2</sub> at 10 mg/l to wine increased estimated phenolics content by 32%. Glucose added at 30 g/100 ml to the tannic acid solution increased estimated phenolics content by 82%; addition at 2 g/100 ml to fruit juice increased the estimate by 20%; and 0.4 g/100 ml in wine increased the estimate by 5%. Absorbance of the reagent solution increased almost linearly with increasing SO<sub>2</sub> or glucose concn. CIH

## 53

Fructose production.

Leiser, R. S. (A. E. Staley Manufacturing Co.)

*United States Patent* 4 310 628 (1982) [En]

Process is described for increasing fructose syrups yields by isomerizing dextrose to fructose in an immobilized glucose isomerase bed. The immobilized glucose isomerase is obtained from *Bacillus* and has an enhanced rate in isomerizing dextrose to fructose when the glucose isomerization reaction is conducted in the presence of Co<sup>2+</sup> ions and at temp. approx. > 60°C. IFT

## 64

Glucose oxidase treatment prolongs shelf life of fresh seafood.

Wesley, P.

*Food Development* 16 (1) 36-38 (1982) [En]

Nutri-Sea Foods, Inc., of Narragansett, Rhode Island, USA have introduced a commercially viable enzymic method which can be used to extend shelf life of fish. The enzyme, a commercial preparation of glucose oxidase and catalase, is applied to the surface of the fish in solution with glucose. The treatment generates gluconic acid, which lowers the pH at the surface of the fish, inhibiting the growth of spoilage microorganisms. Application can be accomplished by means of a dip, by storage in specially prepared enzymic ice, or by immobilizing the enzyme in algin blankets. The method offers savings in extended shelf life, in reduced drip loss in storage and in better wt. retention. Investigations on microbial spoilage showed that in control samples, total aerobic counts reached 'spoilage level' (putrefaction) after about 10 days. Fillets dipped in glucose oxidase/catalase/glucose solutions, did not reach spoilage level until the 17th day. Sensory evaluations of flounder fillets showed that controls stayed within the acceptable odour range for 8 days, while treated samples remained acceptable for 15 days. VJG



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